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ERP and Changing Work: knowledge management in practice

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Abstract

ERP success is becoming critical for universities as at least 85% of Australian universities are adopting at least one module of an ERP system (Beekhuyzen et al., 2002). This paper explores whether ERP systems enable knowledge management activities to occur in a university environment. The knowledge management processes identified in the theoretical framework are mapped to the ERP processes in the university environment. The influence of the organisational/ social enablers on the ERP processes is also discussed. This research was an emergent issue from a larger project. It suggests that knowledge management activities can and, in this case, do exist in a university ERP environment and that the enablers can be an influencing factor. Universities can benefit from understanding and fully utilising their knowledge management activities to improve data access, storage and dissemination of the existing knowledge that exists within the ERP environment.

Keywords

INTRODUCTION

Australian university computer systems are changing due to Y2K, the introduction of a Goods and Services Tax (GST, commonly known elsewhere as a Value Added Tax (VAT)), and university restructuring policies. The restructuring policies have forced universities to become more competitive and Koskinen (2001) suggests that this advantage is derived from knowledge. Changing university environments are calling for new technologies. ERP systems have been identified as offering the strategic solution to the different problems of Higher Education Institutions (Allen and Kern, 2001).

This paper attempts to addresses a gap in the literature on ERP systems (Allen and Kern, 2001; Beekhuyzen *et al.*, 2002) and knowledge management (KM) in universities as these topics have only been researched briefly in regard to a university environment (Chan and Rosemann, 2001). The literature gap is exacerbated as the world's leading ERP vendor is said to be used by over 350 universities worldwide (Allen and Kern, 2001). Eighty-five percent of Australian universities have adopted at least one module of an ERP system (Beekhuyzen *et al.*, 2002). This research will explore the use of information technologies, specifically ERPs, in enabling knowledge management activities within a university environment.

This research is presented as a case study involving a number of observations and interviews with system users. The case study was conducted in a large Australian university. The university studied is one of many Australian universities (Beekhuyzen *et al.*, 2002) and universities worldwide (Allen and Kern, 2001) that are adopting an ERP system. Particularly, this case study focuses on the activities of a specific ERP scenario (a sub-system of the Human Resource (HR) module) that deals with the processing of employee wages.

So, do ERP systems enable knowledge management? This paper firstly explores whether knowledge management activities exist in relation to the ERP. Secondly, it investigates if the ERP system processes can be mapped directly to the knowledge management activities that exist with the ERP. Of particular interest (thirdly) is the influence that knowledge management enablers (identified in the theoretical model, discussed in section Theoretical Framework) have on the knowledge management activities. These issues are explored through the case study.

Knowledge Management has been defined in many different ways. Knowledge Management, in this paper, is concerned with the generation, representation, storage, transfer, transformation, application, embedding and protecting of organisational knowledge (Schultze, 1998). A definition that considers knowledge management systems within a complex system environment (such as an ERP environment) is presented by Hoffman *et al.* (1999:2) as:

> *…organisational, social and technological sub-systems that combine continuous organisational design, development of human resources, and innovation of technology. Success can be ensured by simultaneous development of all parts of the KMS and their mutual adaption.*

This paper will discuss ERP systems and knowledge management, and will attempt to link the two concepts in a case study scenario. The Organizational Knowledge Management Model (Holsapple and Joshi, 1999) is applied to the case study to enable an understanding as to whether ERP systems enable knowledge management.

ERP SYSTEMS

Generally, an ERP is an "on-line interactive system that can provide a 'total' solution to an organisation's information systems needs by addressing a large proportion of business functions" (Brown and Vessey, 1999:1). ERP systems enable the automation of tasks involved in performing a business process so it is integral that implementers start with a clear articulation of the business problems being addressed (Slater, 1999). The most common reason that companies walk away from multimillion-dollar ERP projects is that they discover that the software does not support one of their important business processes (Koch *et al.*, 1999). Not only do the business functions need to be identified, the more subtle issues such as the company's corporate culture and management style must be examined (Slater, 1999) to enable a holistic view of the implementation. The implementation of an ERP changes the way organisations do business and how people carry out their jobs (Koch *et al.*, 1999). In 1999, the Gartner Group forecasted that the Enterprise Systems market would be greater than $20 billion by 2002 (in Rosemann, 2001).

Implementing ERP systems can be a knowledge-intensive task (Rosemann, 2001). Organisations implementing change by way of an ERP system, can find that knowledge management is strategically advantageous as it seeks to deal with leveraging knowledge resources in an organisation (Rosemann, 2001). "Having made costly errors by disregarding the importance of knowledge, many organisations are struggling to gain a better understanding of what they know, what they need to know, and what to do about it" (Davenport, 1998:123). Above all, ERP systems require a stable and consistent methodology, strong project management practices and an enthusiastic and skilled project team (EMBPWG, 1998) in order to succeed.

There is a lack of literature discussing ERP implementations in a university environment (Allen and Kern, 2001; Beekhuyzen, 2001). This research attempts to contribute to the understanding of the use of these large, complex systems within a university environment.

KNOWLEDGE MANAGEMENT

Knowledge management in this paper refers to the electronic transfer of knowledge within a web-based system. There seems to be a lack of effective knowledge management by the bulk of organisations (Holsapple and Joshi, 1999) as there is no consensus as to what actually constitutes knowledge (Biggam, 2001) and the activities that make up knowledge management. ERP systems are the current technology solution of choice for universities worldwide (Allen and Kern, 2001) so universities need to look at ways of effectively managing their knowledge. Ways in which ERP systems capture, codify and store knowledge needs to be explored in the context of universities. Holsapple and Joshi (1999:5) have attempted to clarify the KM literature by identifying the characteristics of the KM phenomena.

They believe that understanding the knowledge management phenomena depends on three activities:

- Characterising organisational knowledge resources that need to be managed.

- Identifying and explaining activities that operate on knowledge resources during the conduct of KM.

- Recognising factors that affect the conduct of knowledge management.

But what is knowledge management? Knowledge Management is concerned with the generation, representation, storage, transfer, transformation, application, embedding and protecting of organisational knowledge and establishing an environment and culture whereby knowledge can evolve (adapted from Schultze, 1998). By considering these activities, we can start to understand how knowledge management exists in relation to an ERP system. Disterer (2001) argues that it is not an individual's knowledge or expertise that is the core asset of any organisation, but the collective knowledge of the teams that make up the organisation.

The organisational knowledge resources present in the case scenario can be characterised in terms of: types of knowledge; employee knowledge, physical systems (Leonard-Barton, 1995) and knowledge mode; tacit or explicit (Nonaka, 1994). Markus (2001:5) suggests that, "only explicit knowledge is the province of information technology, including the communication systems by which people informally share their observations". This case study analyses the explicit knowledge use and reuse within the ERP environment.

Knowledge bases provide users with the ability to browse history and ask the question, "How did we do this last time?" (EMBPWG, 1998). This can improve problem resolution time and assist in key tracking and reporting of key information (*ibid*).

Chan and Rosemann (2001) argue that knowledge resources can be better managed by revealing the transparency of what knowledge is required at which point in time during the ERP implementation phase, and where the knowledge resides. By identifying and explaining activities that operate on knowledge resources, we can get an understanding of the configuration of the elemental knowledge activities. These activities are discussed in section Theoretical Framework.

Several of the existing knowledge management frameworks explicitly recognise the influence dimension of KM (Holsapple and Joshi, 1999). These influences govern which manipulation activities are applied to which knowledge resources (*ibid*). Refer to section Theoretical Framework for more discussion of the KM influencers/ enablers; culture, technology, leadership, measurement.

RESEARCH METHODOLOGY

One large Australian University that is implementing an ERP was chosen for this research. Particularly, one School in the university was studied in detail. In order to explore the research question, a case study employing multiple methods of data collection (Benbasat *et al.*, 1987) was conducted within the specific school in the university. The methods used were qualitative in nature (discussed below) and focus on the use of ERP systems in the implementation phase. This research is based on a pilot study of a HR system within the university.

The findings presented in this paper are preliminary, and further research is planned which will further explore the use of this module and then other modules of the ERP system in relation to knowledge management activities. Further research within this organisation (the university) is currently being conducted.

Before the system was introduced, a group training session was observed. In this session, the implementation staff outlined the functionality of the system and users were invited to ask questions. This was followed by non-participant individual observations of seven users using the system for the first time. Ten interviews of approximately half an hour in duration continued to explore the nature of the influence of the system on the users work environment and culture. This exploration also enabled the knowledge activities to be identified. The majority of the users that were interviewed had previously been involved in the observation sessions.

User's behaviour and interaction with organisational artifacts, namely the new system, was then analysed interpretively using NUD*IST, a qualitative analytical tool. In the interpretive knowledge management area, knowledge is viewed as a continuous accomplishment or process rather than as an object (Schultze, 1998). Case study research, and an extensive review of the knowledge management and ERP literature has been beneficial in gaining a deeper understanding of the issues surrounding the ERP system knowledge activities.

This empirical research has been carried out for a larger project, which analysed the influences of ERP systems implementation on organisational culture (Beekhuyzen, 2001). Knowledge management emerged as an important cultural issue and this paper attempts to address knowledge management partly within that cultural context. This paper reviews the data in terms of the Organizational Knowledge Management Model presented by Arthur Andersen and AQPC (Holsapple and Joshi, 1999) (refer Figure 1).
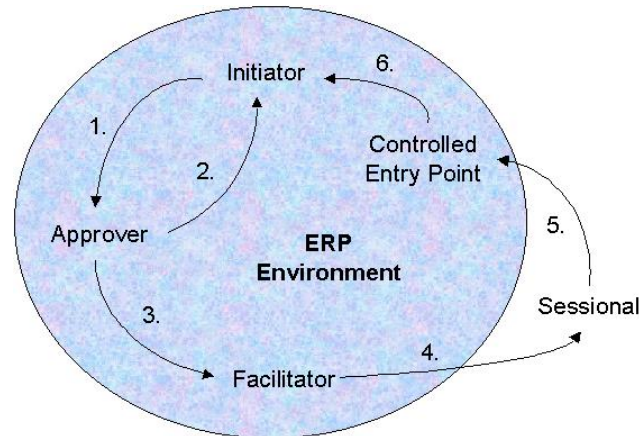

Figure 1: Organisational Knowledge Management Model (Holsapple and Joshi, 1999)

THEORETICAL FRAMEWORK

Holsapple and Joshi (1999) have extensively summarised and compared a variety of knowledge management frameworks and have concluded that while each of them addresses certain KM elements, none of them subsumes all others. The list provided by Holsapple and Joshi is by no means exhaustive although it is comprehensive. Other than the descriptive frameworks discussed in this paper, other specialised descriptive and prescriptive frameworks exist. Some of these frameworks are now discussed.

Choo's framework for the 'Knowing Organisation' represents the way an organisation uses information strategically for sensemaking, knowledge creation, and decision making (1996).

The framework for 'Knowledge Management Pillars' that is proposed by Wiig focuses on the three major functions needed to manage knowledge. These two frameworks have little focus on resource differentiation (Wiig, 1993). A criticism of Wiig's framework is that, "the model uses the terms "knowledge" and "information" without commenting on the existence or nature of any distinction between them" (Holsapple and Joshi, 1999:5).

The 'Core Capabilities and Knowledge Building' framework proposed by Leonard-Barton (Holsapple and Joshi, 1999:2) identifies four core capabilities and four knowledge-building activities that are crucial to a knowledge-based organisation. The high level treatment of knowledge manipulation activities is a criticism of this framework (Holsapple and Joshi, 1999:5).

Arthur Andersen and APQC's 'Model of Organisational Knowledge Management' (Holsapple and Joshi, 1999:2) explores the knowledge management processes that can operate on an organisation's knowledge. Four organisational enablers of the knowledge management process are also represented. It has been argued that this model considers influences only as KM enablers (Holsapple and Joshi, 1999) and not as possible impediments but this lack of detail makes the model more applicable to multiple environments. The nature of the enablers are not detailed, leaving this open to interpretation.

'Activities in the Knowledge Lifecycle' are explored by Chan and Rosemann (2001). Their framework identifies the activities present in the knowledge lifecycle; identify, create, transfer, which focuses on ERP use. Chan and Rosemann's model has a much wider applicability, suitable for the whole lifecycle of an ERP system.

In addition to those identified by Holsapple and Yoshi, Markus (2001) discusses the knowledge reuse process in terms of "capturing/ documenting knowledge, packaging knowledge, distributing/ disseminating knowledge and reusing knowledge".

From the above discussion, The Model of Organisational Knowledge Management (below) provides a basis for benchmarking the conduct of KM within an organisation (Holsapple and Joshi, 1999). It has been chosen as the most appropriate framework for this research as it explores the aspects that can affect the knowledge activities. The processes discussed by Markus (2001) can also be identified within the chosen framework.

In this model, surrounding organisational knowledge are the KM processes that exist in the work environment. These processes represent the way the knowledge is created, identified, collected, adapted, organised, applied, and shared in the organisation (or part of it, as in this research).

The KM enablers (leadership, measurement, culture and technology) can be examined in terms of how they impact on the knowledge processes and, in turn, how they enable (or disable) knowledge activities. This framework is applied to the case study situation, illustrated in Figure 2.
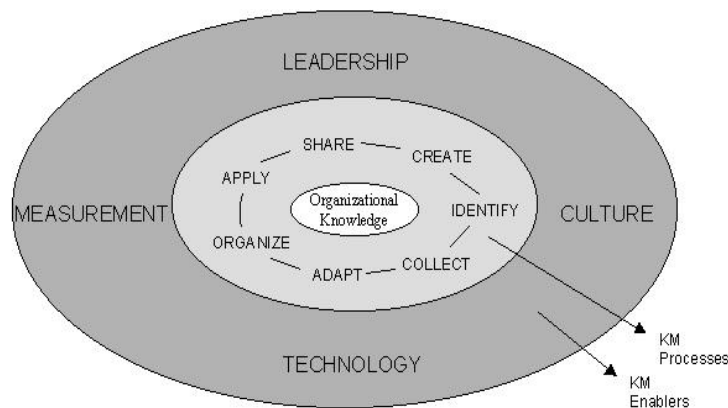

Figure 2: ERP system processes in the university environment

DISCUSSION – KNOWLEDGE PROCESSES

"The intelligence employed in everyday work practices is crucial for actually getting work done" (Sachs, 1995). The ERP knowledge processes are identified in the following model. The theoretical framework is now explored within the case study scenario.

Figure 2 represents the processes involved in the ERP case. These processes can be recognised as being KM processes (Figure 1), see Table 1.

ERP Process	Description	People Involved	KM Process
	Register with the system	NABS Staff	Create
1	Sessional details are entered in the work schedule (WS) and submitted for approval	Initiator, Approver	Create Identify Collect
2	WS is not approved and is recycled (returned) to the initiator	Initiator, Approver	Adapt
3	WS is approved and is submitted for facilitation	Approver, Facilitator	Organise

ERP Process	Description	People Involved	KM Process
4	WS is processed, printed and sent to sessional employee for confirmation	Facilitator, Sessional Employee	Apply
5	Sessional Employee confirms appointment by signing form and returning it to a Controlled Entry Point (HR/ payroll)	Sessional, HR staff	Apply
6	Confirmation (an email) is sent to the initiator to confirm appointment	HR staff, Initiator	Share

Table 1: ERP system process description

Table 1 maps the seven KM processes that operate on the universities knowledge to the ERP system processes. Each of these processes is now discussed.

Initially, all users need to be registered with the system by the implementation staff. The sessional employee's details are entered in the work schedule (WS) by the initiator and submitted to the approver for approval. This ERP process can be seen as "creating", "identifying" and "collecting" knowledge, e.g. creating a new WS, identifying the employee involved and collecting the necessary knowledge such as hours to be worked. Initial registration may also be seen as "creation".

If the Work Schedule (WS) is not approved, it is recycled (returned) to the initiator, and the initiator "adapts" the knowledge. When the WS is approved and is submitted for facilitation, the knowledge is "organised". The knowledge is applied when the WS is processed, printed and sent to sessional employee for confirmation by the facilitator. The knowledge is also "applied" when the sessional employee confirms the appointment by signing the form and returning it to a Controlled Entry Point (the university). The knowledge is "shared" when a confirmation email is sent to the initiator to confirm the appointment.

Knowledge management is made up of processes and 'people-factors' (Holsapple and Joshi, 1999). Ruggles (1998) argues, "If the people issues do not arise, the effort underway is probably not knowledge management". The KM processes have been explored and the 'people-factors', the organisational enablers of the KM model, are discussed in the next section in relation to the KM literature and the case study.

DISCUSSION – ORGANISATIONAL ENABLERS

The argument so far has shown that KM processes do exist in a university ERP environment. It is necessary for knowledge workers to seize the knowledge and use it for the university's advantage. Whether or not the KM enablers; culture, technology, leadership and measurement (suggested in the chosen framework) do actually enable the KM processes is now discussed.

Culture

Knowledge is used for individual benefit and it is shared with caution. The necessity of sharing knowledge in an organisation to use the knowledge resources effectively is said to be a critical success factor for implementation (Disterer, 2001). Disterer (2001:1) argues that our society has deep cultural traditions which tend to discourage knowledge sharing.

Empirical evidence has suggested that cultural aspects like employee's individual and social barriers are critical for knowledge management initiatives (Disterer 2001:3). Culture has been identified as a significant impediment to knowledge management (Ruggles, 1998). The biggest difficulty in managing knowledge has been identified as changing people's behaviour of transferring and sharing knowledge with their colleagues (Disterer, 2001:3). It has been agreed that the success of knowledge management initiatives relies heavily on the addressing of cultural issues as superior to technical issues (Disterer, 2001; Ruggles, 1998).

In the case study, system use was compulsory. Each role (initiator, facilitator, approver) with the system has responsibility for certain knowledge. As this knowledge was not domain specific or expert knowledge, the system users were quite willing to share it. This may have been encouraged also because this was a pilot study and feedback to the implementers was

part of the pilot process. It was found that the users were a fairly homogenous group in terms of their organisational culture (Beekhuyzen, 2001) but the sharing of knowledge was a more common practice within sub-cultures than across sub-cultures within the School. The study suggests that culture is not a barrier but rather an enabler of KM.

Technology

The opportunities to foster knowledge transfer with Information Technology are manifold (Disterer, 2001). Various kinds of information systems can be considered in order to organise, formalise, maintain, distribute, apply and evolve knowledge within the organisation (Disterer, 2001). ERPs are the latest enterprise software to manage organisational knowledge. This was illustrated in the discussion of the Theoretical Framework.

There is no doubt that implemented technology has an influence on the way KM processes are performed. The technology chosen will affect the way the knowledge is captured, codified and stored in the university. As ERPs are enterprise wide solutions, they enable knowledge to flow more freely throughout the system. Each department throughout the university in the case study is using a common interface to access the system. The ERP system is now the only way to carry out certain work practices, increasing the centralisation and decentralisation of knowledge simultaneously. Technology, in particular the ERP, is an enabler of KM in a university environment.

Leadership

Knowledge sharing is based on the consistent, reliable, plausible behaviour of management (Disterer, 2001). In a well-known survey by Ernst & Young (in Ruggles, 1998), top management's failure to signal the importance of knowledge management has been ranked highly (32% of respondents). This could be understood as an indicator that paradigms of the organisations are not communicated and understood effectively (Disterer, 2001). It is necessary for management to allow time for communication and networking. Mutual trust, led by management is necessary among organisational members to enable the sharing of knowledge (Disterer, 2001).

In the case study, system use was made compulsory and encouraged by the School Head. Other influential leaders in the school (e.g., Deputy Head of School, the School Executive Support Officer) and outside the school but within the university (the implementation team) advocated use and were helpful, patient and available when dealing with problems encountered. The initial training session was a knowledge sharing experience as was the feedback given to the implementation team. It is believed that leadership, in relation to the ERP, was very influential in enabling the knowledge processes.

Measurement

Measuring the KM processes can be seen as a management activity. The distinction can be made between managing hard and soft knowledge (Nonaka, 1994; Hildreth *et al.*, 1999). To measure the correctness of the hard (explicit) knowledge that is being captured, codified and stored can result in the assurance that the explicit knowledge is being managed. The measurement of this explicit knowledge is represented in the Integration stage presented by Lee *et al.* (2001) that evaluates the effectiveness of the knowledge. Explicit knowledge is being managed in the case study situation.

Managing soft (tacit) knowledge is much more of a challenge as it is less quantifiable and cannot be captured, codified and stored so easily (Hildreth *et al.*, 1999). Soft knowledge is embedded in the practices of, and relationships within, the group (*ibid*). As a culture for managing the explicit knowledge is present, measuring the quality of the tacit knowledge is the next challenging task and is represented in the networking stage of implementation, as presented by Lee *et al.* (2001).

This phase measures the internal and external knowledge management efficiency. As this is a pilot study and this research was completed before the pilot completed, the measurement activities are not known, therefore, it is not known if measurement is an enabler or disabler of KM activities in a university environment.

FINDINGS

University academic staff are expected to be individual 'knowledge workers' and to share their work with the wider academic community (Slade and Bokma, 2001:1). Universities are keen to exploit the Internet (Biggam, 2001), emphasised as the case implementation being studied is fully web-based.

Biggam (2001) stresses the importance for universities to understand their website contents, and the processes to produce and maintain these contents, from a knowledge management perspective. As knowledge sharing is important at the enterprise level, approaches are required to facilitate the recording of knowledge and encourage effective sharing of it with colleagues (Slade and Bokma, 2001:1). The ERP process in the case study currently concentrates on capturing the explicit knowledge that exists with the ERP, so to gain a deeper understanding of the knowledge management activities; there is a need to focus on capturing the tacit knowledge as the explicit knowledge is already represented.

The analysis of the ERP implementation reveals the severity of the knowledge gap between ERP and knowledge activities. Each key stakeholder to this process; key users (initiators, facilitators and approvers), IS department personnel, and the ERP vendor, have different and specific knowledge about organisational requirements, the existing IT infrastructure and package functionality (Soh *et al.*, 2000). While frequent interaction and joint problem solving appear to be the logical way to bring the disparate knowledge together, it is difficult to transfer this knowledge from one stakeholder to another.

The varied backgrounds and interests of the parties make it difficult to achieve an integration of this knowledge (Soh *et al.*, 2000) but it is the synergic behaviour of these stakeholders that is the driver for knowledge transfer (Disterer, 2001). This research findings from the larger project that this study is drawn from suggest that the transfer of knowledge within the sub-cultures that exist is possible but is it much more difficult across sub-cultures. The knowledge activities have been identified to exist to support this transfer of knowledge, but it is still important for users across the organisation to embrace the knowledge management activities and to utilise them to gain maximum benefit from the IT infrastructure.

CONCLUSION

It is no longer sufficient for users to be passive functional experts as in traditional system development projects. They have a much bigger role in implementation with ERPs. The user's culture, ideas, experience and knowledge have become part of the process (Grove and Segars, 1996) and it is all of these factors that make up the knowledge management activities.

In this study, an ERP system was investigated from a knowledge management perspective. Through the use of a case study and a theoretical framework, it has been established that knowledge management activities do exist in an ERP environment and the KM enablers influence them. Culture, technology and leadership are strong KM enablers but it is unknown whether or not measurement is an enabler. Further studies in this area would help to clarify the role of measurement in the KM activities.

This paper highlights many questions with respect to knowledge management in an ERP environment. Some of these questions have been addressed but others still require further research that is being carried out by other researchers at the research site.

Universities can benefit from utilising the knowledge management activities present within the ERP environment to improve data access, storage and dissemination of existing knowledge that exists with the ERP. The influence of the enablers on the KM activities should be carefully considered to understand the full potential and impact of the knowledge management activities.

Being unaware of the measurement activities to be used is a limitation of this research. The Arthur Andersen and QPAC article with the original framework was unattainable for this research that was another limiting factor. Also, it is recognised that only focusing on one small part of the ERP could be problematic and limiting, and that the complexity of the ERP has not been captured, however it is believed that the KM activities that are evident in this case study would also be identifiable in other parts of the ERP system.

Suggested future research might be the application of the theoretical framework to another organisation, maybe another university environment to increase it's validity. Another KM framework could also be applied to this particular case study for validation. A closer investigation of the measurement component of the model would also enable a better understanding of its influences.

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