

KNOWLEDGE MANAGEMENT IN SUCCESS OF ERP SYSTEMS

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ABSTRACT

Special attention to critical success factors in the implementation of Enterprise Resource Planning systems is evident from the bulk of literature on this issue. In order to implement these systems, which are aimed at improving the sharing of enterprise-wide information and knowledge, organizations must have the capability to effectively share knowledge to start with. Based on a review of the literature on knowledge management in enterprise system implementation, this paper identifies two major areas of concern regarding the management of knowledge in this specific type of project: managing tacit knowledge, and issues regarding the process-based nature of organizational knowledge viewed through the lens of organizational memory. The more capable an organization is in handling these issues, the more likely it is that the implementation will result in competitive advantage for the organization. The competitive advantage arises from the organization's capabilities in internalizing and integrating the adopted processes with the existing knowledge paradigms and harmonizing the new system and the organizational culture towards getting the most out of the implementation effort.

KEYWORDS: Knowledge, Knowledge Management, Enterprise Resource Planning, Project Management

I. INTRODUCTION

Enterprise resource planning (ERP) systems are popular among enterprises, with many organizations wanting to implement an ERP system, yet the rate of failure is quite high. Enterprise resource planning software presents a framework for an organization to help them improve their business processes. It consists of a wide range of software products supporting daily organizational business operations and decision making. ERP systems automate operations in supply chain management, inventory control, manufacturing scheduling, sales support, customer relationship management, financial and cost accounting, human resource and other business functional areas within an organization.

Knowledge management (KM) is playing an important role in society, and becoming a compelling issue within enterprises. In this article, we report on a systematic review of empirical studies of knowledge management in enterprise resource planning projects. Our main goal is to provide a clear overview of empirical studies within the ERP research field, identifying the concepts that have been explored in ERP projects, the main findings, and the research methods that have been used within this area.

The target readership of the review is four groups which we expect will be interested in an overview of empirical research on knowledge management in ERP projects: (1) academic and enterprise researchers on knowledge management in general, who would be interested in making comparisons ERP projects; (2) practitioners within enterprises, who will be interested in learning about knowledge management initiatives in ERP project implementation; (3) knowledge management researchers who are interested in designing studies to address important research gaps in this field; and (4) researchers who are interested in identifying the relevant studies, and the major findings and their implication within the field.

The structure of our research paper is as follows. Section 2 presents the background and general theories on knowledge management for ERP projects. Section 3 describes the research method that we use to select and review the data material for our research, and presents our chosen framework for

analysis. Section 4 presents the results of the systematic review according to our chosen framework. In Section 5, we discuss and conclude the findings and their implications. For the implications for research, we identify what we believe are the most important research gaps. For practitioners, we provide advice on how to use the results in practice.

II. BACKGROUND

In this section, a brief introduction to enterprise resource planning and our research focus together with our research question are presented. The remainder of the article presents the overview of the current work on knowledge management in ERP projects.

2.1 Knowledge Management

Knowledge is derived from data and information [20]. Knowledge management is the management of information and knowledge and their usage in organizational business processes within the organization. The main focus of knowledge management is steering strategy and, identifying and communicating the various types of knowledge that reside in processes, people, products and services in order to support integration to improve productivity and efficiency. Based on the knowledge management literature review, the conclusion can be made that knowledge resides in organizational resources, employees and external partnerships. Knowledge is categorized to pursue different research interests, [17] namely, the tacit and explicit dimensions of personal knowledge and processes required for managing to create organizational knowledge. Three knowledge types are identified by Petrash's framework [18]. Based on the knowledge management literature, knowledge management processes are studied in accordance with distinctive and various types of knowledge and organizational objectives. It has traditionally been assumed that there are three broad types of knowledge processing: generation, transfer, and utilization. For example, Probst et al. [20] identified six knowledge processes required for managing organizational knowledge. Knowledge integration is viewed as an important process for innovation and building organizational capability [10], [23]. Coombs and Hull [5] identified ten distinctive processes, namely, identification, transfer, utilization, creation, acquisition, retention, codification, validation, developing, and integration of knowledge.

2.2 Knowledge Management from the ERP Project Perspective

An ERP system allows an organization to have a convergent and integrated view of the organizational information by means of centralized databases and integrated business processes across the lines of different divisions and departments [9, 23, 19]. It could be said that as a result of enterprise system implementation, the organizational information and knowledge converges across different divisions and departments on an organization-wide scope. IT experts need to know more about the business processes and business process experts need to leverage their knowledge about the IT systems in place in their organization. Eventually, the overlap between the knowledge of different divisions increases and the knowledge on the organizational scale follows a converging pattern. However, this convergence on the organizational level tends to turn into divergence as we move down to the individual level [2, 17].

A broader knowledge of the organization is required for end users of enterprise systems compared to the traditional legacy systems that were adapted to each island of automation. As the view changes from the task focus to the process focus by implementing enterprise systems, employees need to know how their tasks fit into the overall process and how that process contributes to the achievement of organizational objectives. For example, an employee working in the customer billing section will need to know more about the IT systems as well as other business areas such as production and accounting. Similarly, the IT experts need to know more about different subject areas to adapt the new system to the areas' requirements and configure the enterprise system to operate optimally. Therefore, as the organizational view of knowledge regarding the tasks and processes that are conducted in the organization tends to converge by the use of the enterprise system, the individual knowledge must diverge to accommodate the changes posed by enterprise system implementation [2, 50, 55].

One major implication of such a view of enterprise system projects is that knowledge sharing needs to be significant across organizational boundaries to allow for the maximum sharing of observations and experiences among employees from different divisions with different mindsets about how the

business is done along the lines of process. Knowledge sharing in enterprise system projects exists along different lines of interaction among organizational members, the ERP team, and external consultants which echoes the need for improved knowledge sharing along different organizational dimensions and in different levels of engagement with the implementation project. The next section reviews different lines of ERP specific knowledge sharing in more detail.

2.3 Knowledge Management in ERP Projects

The simultaneous implementation of enterprise resource planning and knowledge management systems in organizations implies some sort of contradiction by its nature. Enterprise systems are meant to increase the organizational efficiency by enhancing the information processing capability of the enterprise [15,19, 60, 62]. This capability enhancement is enabled by the systematization and centralization of information management and the adoption of standard approaches to the codification and processing of information. On the other hand, knowledge management initiatives aim at mobilizing the knowledge through organized knowledge repositories of explicit knowledge and communities of practice as a means of sharing and creating tacit knowledge, having their overall focus on improving innovation capabilities by increasing flexibility [4,7, 22, 24].

While it is traditionally believed that it is impossible for an organization to focus on both efficiency and flexibility, Newell et al. [19] show, by analyzing a case, that enterprise system and knowledge management initiatives are complementary rather than contradictory. Assuming enterprise systems are integrated databases of organizational information and explicit knowledge, as opposed to knowledge management initiatives being methods of managing tacit knowledge, their findings suggest that a balanced perspective of ERP and KM systems can assist in exploiting explicit knowledge as well as exploring and sharing tacit knowledge simultaneously. In other words, utilizing the respective strength of the enterprise system and KM in tandem enables the alignment of organizational capabilities in information processing, knowledge exploration and exploitation [19]. Knowledge management techniques are used over the course of enterprise system implementation and during different steps of implementation projects to facilitate this knowledge sharing [8]. A detailed view of how the knowledge of ERP project members evolves during these different stages is discussed next.

III. METHOD

In this research, we use the systematic review approach based on [61-62]. Guided by, the research question, we identify the relevant research, carry out a selection process, appraise, synthesize and draw inferences. Finally, we address each of them.

3.1. Review Planning

We begin by providing a protocol for the systematic review, specifying the process and methods that are used. We aim to use the protocol to specify the research questions, research strategy and method of synthesis.

3.2. Research Identification

This systematic research started with the identification of the keywords and search terms. We used general keywords to search for many and various relevant papers regarding knowledge management and ERP projects. The search strategy for the review was directed towards finding published papers in archival journals, conference proceedings and technical reports from the contents of four electronic databases, namely, ACM portal, Elsevier's Science Direct, IEEE Xplore and Springer-Verlag's Link. The search terms used were: software selection criteria, software evaluation techniques, software selection methodologies, evaluating and selecting software packages, method for evaluating and selecting software packages, criteria for evaluating and selecting software package, software evaluation criteria, systems/tools for evaluation and selection of software packages, knowledge-based systems for software selection, framework for evaluating and selecting software packages, and software selection process.

Other relevant journals found while searching the articles on this topic are Information and Management, Information and Software Technology, and European Journal of Operational Research. Articles published in proceedings of the IEEE on Software Engineering, Springer-Verlag,

International Conference on COTS-Based Software System were also found relevant to this topic. The series of articles on evaluating software engineering methods and tools (part 5 to part 8), ACM SIGSOFT, is one of the major contributions to this topic.

3.3. Paper Selection

Our selection process had two parts: (i) an initial selection from the search results, based on reading the abstract of the papers; and (ii) final selection from the initially selected list of papers, based on reading the entire paper. The initial list consisted of 130 papers which we found relevant to the topic and potential candidates for inclusion in our review. Initial selection of the paper was done jointly by both the authors on the basis of reading the title and abstract of the paper. The first author then read all 130 papers in detail and considered 62 papers to be included in the final list for review. In the second phase of selection, we eliminated 4 papers that did not give any useful information on evaluation criteria, evaluation technique, selection methodology, and systems/tools for software selection. The second author cross-checked whether the papers in the final list considered for review addressed the research question and contributed to the basic purpose of the review. A random sample of 25 papers was selected for the cross-checking. There was no disagreement on the final selection of papers. The search began in early 2006 and was completed in early 2007.

3.4. Data Extraction

In the data extraction phase, the first author read every selected paper and extracted information about the attributes as set out in Table 1. The extracted data were then cross-checked by the second author by random selection of 20 papers, that is, about 30% of the total. During the data extraction phase we found that four papers did not give any useful information on software selection methodology, evaluation criteria, evaluation technique, and systems/tools for software selection. Therefore, those papers were not considered when presenting the results of the review.

3.5. Synthesis

For the synthesis, we chose to only use the papers classified as empirical studies in our framework, in order to avoid problems associated with lessons learned reports stemming from their lack of scientific rigor. We extracted concepts covered, main findings and the research method for each article. One researcher (the first author) focused on the studies in the technical schools, while the other researcher (the second author) focused on the behavioural schools.

IV. RESULTS

This section describes the analysis of the data extracted from our selected studies. The contribution of the reviewed literature in the field of knowledge management in ERP projects is presented, which focuses on the dimensions that should be considered when implementing an ERP project. It shows clearly that various areas of knowledge have been acquired from the literature review. There are similarities between the areas of knowledge, and the consistent expression of the need for this knowledge from the case studies emphasizes that this knowledge should be made explicit. These areas of knowledge are organized to a more manageable form in the following section.

From the literature reviewed, three dimensions of knowledge are clearly identified for the successful implementation of an ERP system. The three dimensions to be considered for successful implementation are:

- i. Project management knowledge
- ii. Business and management knowledge
- iii. Technical knowledge.

Project management knowledge refers to the knowledge required to manage the entire implementation process as a single project. Business and management knowledge refers to the knowledge about issues and knowledge to deal with these issues during and after implementation. These issues are often people-related and occur on a higher management level. Technical knowledge refers to the knowledge required to install and implement the ERP system [58].

Table 1. Knowledge management for ERP project success

Stage of ERP	KM Types	Role of KM	Successful Output of KM
Selecting ERP for implementation	Business and management/ project management	Identifying the right package	Business/organizational satisfaction
Implementation process	Technical	Creating good integration b/w business and system	Business/organizational impact
Using ERP after implementation	Business and management	Using, transferring and storing data	Flow quality information
Changing ERP when needed	Business and management/Project management	Re/using	System quality/ Business

V. DISCUSSION AND CONCLUSION

By comprehensive review of the literature on enterprise system knowledge management, this paper investigated the major concerns of the different lines. The first area concerns the effects and implications of the tacit category of ERP-specific knowledge. The subject of tacit knowledge management is addressed extensively in the literature and different issues along with their respective mitigating solutions are provided in various research works [16, 5, 10]. These solutions include the presence of tacit knowledge sharing facilitators during enterprise system implementation [28, 20, 10], and paying attention to the structure of team interactions and the atmosphere of the team. Proper utilization of each method can assist the adopting organization to overcome the difficulties of tacit knowledge sharing. Organizing communities of practice composed of the different groups involved in different stages of the enterprise system lifecycle is another way to overcome the difficulties of transferring such knowledge from where it resides to where it is needed. In the case of running the enterprise system project on distant locations [18], virtual communities centered on company intranets or the internet act as the facilitating bridge among separate bodies of knowledge across the entire enterprise.

The process-based nature of organizational knowledge is the second area of concern in enterprise system knowledge management which was examined from the lens of organizational memory [29,30]. Organizational processes embed substantial knowledge of the organization's history and can be regarded as the organizational memory. Viewing the ERP knowledge through the lens of organizational memory sheds light on some interesting issues of concern in ERP implementation projects [31, 33]. Arranging powerful core enterprise system implementation teams and effective utilization of external consulting were identified to be among the most preferred methods of dealing with the knowledge barriers connected with enterprise system configuration caused by difficulties associated with organizational memory. The standardization which results from adopting the same best practices of enterprise system packages by many organizations might give rise to concerns about losing competitive advantage. In particular, the two subjects reviewed here are very illustrative.

Finally, managing ERP-related knowledge across its lifecycle (pre-, implementation and post-implementation) is also an interesting area. For example, exploiting the contribution from disciplines such as ontology engineering into this area would give benefits within the context of ontology-based applications for enterprise systems. This may enhance the whole performance of ERP lifecycle knowledge management activities. An initial insight into this direction is systematically presented in [56] and an example is available from previous work such as [57].

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