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ERP AND KNOWLEDGE MANAGEMENT SYSTEMS: MANAGERIAL PANACEAS OR SYNERGETIC SOLUTIONS?

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Abstract

This paper considers the complementary implementation of ERP and KM systems in a particular company. In particular it considers how, in tandem, these systems can aid organizational efficiency and flexibility. In so doing, it compares with the four mechanisms of organizational efficiency and flexibility proposed by Adler, Goldofas and Levine (1999), identifies implications for both theory and practice, based on a consideration of content, context and process (Pettigrew and Whipp, 1991).

Introduction

Two new systems initiatives that are currently being or have been widely implemented in organizations are ERP systems (Cerullo and Cerullo 2000) and knowledge management (KM) systems (Davenport, De Long and Beers 1998). ERP systems are marketed as a vehicle for integrating the core business activities of an enterprise, such as finance, logistics and human resources, and as a means of overcoming problems associated with so-called “legacy systems” (Communications of the ACM 2000). They are based on developing a common IT infrastructure and business processes, where previously, especially in a large globally distributed corporation, many incompatible systems and processes co-existed, making integration difficult. The suggestion is that these systems can play an important part in leveraging organizational competitiveness through improving the way in which strategically valuable information is produced, shared and managed. By streamlining these processes organizational efficiency should be enhanced. KM systems emphasize how firms can enhance competitive advantage through the more effective utilization of their knowledge assets. This is to be achieved by allowing free flow of knowledge across organizations (Starbuck 1992). Through improved knowledge sharing and knowledge creation, flexibility and innovation should be enhanced (von Krogh et al. 2000). While prior studies have provided useful insights on each of these initiatives independently, few empirical studies examine both phenomena in tandem. In this paper we examine the extent to which these two initiatives, when enacted within a single organization, are complementary or contradictory, and how the combination of the two influences organizational efficiency and flexibility.

Conceptual Foundations

The ability of firms to effectively respond to environmental opportunities, while simultaneously developing efficient internal processes, has long been seen as central to an organization’s success (Geletkanycz and Hambrick 1997). A large body of literature has focused on examining the interface between the external environment and internal organizational processes, providing theoretical explanations that pinpoint the needs for efficiency and flexibility (Davidow and Malone 1992), and more critically a tradeoff between them (Ghemawat and Costa 1993).
Influenced largely by the information processing paradigm, one stream of theoretical development has tended to focus on improving efficiency through the continuous accumulation of information (e.g. Cyert and March 1963). Others have emphasized the importance of organizational design for improving efficiency (e.g. Galbraith 1977). This emphasis on efficiency has been repeatedly reinforced by contemporary management theories and practices, notably the implementation of total quality management (Zbaracki 1998) and the adoption of information technology (Frohlich and Dixon 1999). A more radical approach is seen in the literature on business process reengineering (BPR) (e.g. Davenport 1993), which advocates that the enhancement of efficiency depends on radically altering routines and practices around processes rather than around traditional functional structures. Antecedents of such approaches – although, curiously, not acknowledged as such, may be found in the systems literature of the 1980s (e.g. Galliers 1987). More recently, as organizations’ dependence on IT for revitalization grows (Orlikowski and Robey 1991), ERP systems have been strongly promoted promising improved competitiveness through increasing productivity, cost reduction, improved decision quality and resource control, thereby enabling leaner production (Communications of the ACM 2000). In other words, ERP systems are promoted as systems that will improve organizational efficiency through both enhanced information capture and organizational redesign.

Meanwhile, conceptual arguments posit that flexibility can only be achieved at the cost of efficiency (Hannan and Freeman 1989). Approaches to improving flexibility have tended to emphasize the need for cross-departmental collaboration and communication to mitigate environmental uncertainty through the adoption of organic organizational structures (Burns and Stalker 1961). Empirical research has thus emphasized how flexibility is achieved when organizations interact with their environment. This is illustrated in approaches such as strategic choice (e.g. Geletkanycz and Hambrick 1997) and absorptive capacity (Cohen and Levinthal 1990). In conjunction with this, some have focused on the essence of continuous organizational renewal and evolution, as reflected in the concepts of organizational learning (Senge 1990), virtual organization (Davidow and Malone 1992) and innovation (Douherty 1992).

Moving beyond the polarity of efficiency and flexibility, there is the suggestion that it is possible for organizations to enhance efficiency while at the same time allowing for flexibility. Some of the empirical accounts include the importance of meta-routines in facilitating non-routine work as reported by Adler, Goldoftas and Levine (1999) and the joint tasks of exploitation and exploration of knowledge (March 1991). Moreover, researchers have found considerable empirical evidence to support the argument that cross-functional or departmental knowledge integration facilitates the mutual-reinforcement of efficiency and flexibility (e.g. Kogut and Zander 1992). In this paper we consider a company that is indeed implementing these two initiatives simultaneously. We do so in order to explore whether they are in practice complimentary or contradictory. Specifically, this paper reports an empirical study that explored the interrelationships between ERP, KM and organizational efficiency and flexibility. The study aimed to answer the following two research questions: (1) How do ERP and KM influence each other when they are implemented within a single organization? (2) How does the combination of ERP and KM influence organizational efficiency and flexibility?

Research Context and Methods

Guided by the above research questions, empirical research based on the case study approach (Stake 1995; Yin 1984) was conducted between 1998 and 1999 to generate in-depth insights. Company A, a top-league multinational player in the engineering industry, designs and manufactures standard and custom-built products and provides consulting services for corporate clients across the globe. The case company commenced its global ERP implementation during the third quarter of 1995, completing it during 1998. The implementation of ERP was facilitated by a leading IT service provider and long-term strategic partner of Company A. During the implementation of ERP, in late 1997, another critical company-wide initiative - knowledge management - was started. The implementation of KM encompassed various initiatives, such as forming a project team and steering group, identifying stakeholder groups, building a corporate-wide knowledge directory and KM website on the firm’s Intranet, and training courses and workshops.

Three sources of evidence were collected from 37 interviews (25 first interviews and 12 follow-up interviews), on-site observation, and examining documentation, including written reports, administrative documents, archives, and newsletters. Multiple data collection methods were employed not only for the purposes of enhancing the richness of findings, but also for the process of triangulation as a means of ensuring the validity of the findings (Denzin 1988). Data collected from these sources was then analyzed based on the coding techniques proposed by Miles and Huberman (1994). Emerging insights were iteratively compared with the literature for the purposes of identifying and articulating theoretical similarities and differences. The following section outlines the research findings derived from the analysis.
Research Findings and Discussion

Guided by the two research questions, the following discussion is structured as follows. To start with, the relationship between ERP and KM will be examined based on a theoretical framework provided by Pettigrew and Whipp (1991). The analysis of content, context and process leads to a discussion of how ERP and KM individually and collectively influence organizational efficiency and flexibility by building upon the theoretical arguments of Adler, Goldoftas and Levine (1999).

Content: Information vs. Knowledge

Evidence from the case depicts that orientation differences between ERP and KM revolve around how the strategic value of information and knowledge is perceived and leveraged. Similar to other empirical studies (e.g. Pereira 1999), the implementation of ERP in Company A concentrated primarily on the efficiency of producing, gathering and managing information. Efficiency improvements were sought through enhancing the information processing capability of the company, enabled by the systematization and centralization of information management and the adoption of standard approaches to the codification and processing of information (Wagle 1998). Meanwhile, the case company’s specific emphasis on knowledge exploitation (March 1991) and distribution (Huber 1991) suggests that the firm’s creation of knowledge largely depends upon the processes of exchange and combination (Nambisan and Ghoshal 1998). The exchange process was facilitated through the organization of communities (Brown and Duguid 1991) and the availability of a corporate-wide expertise database.

These distinctive foci and orientations indicate that ERP and KM can be perceived as being complementary because each system is designed and implemented for a clearly defined managerial purpose, notably managing organizational information or knowledge. The two systems can be mutually reinforcing because the organization’s information processing capability influences how knowledge can be effectively created, exploited and captured (Nambisan et al 1999). However, such a co-relation resulting in the mutual reinforcement between ERP and KM can also mask and overlook the distinctive, and yet mutually interdependent, nature of information and knowledge. Information has to be interpreted and this interpretation will depend on one’s knowledge (Galliers and Newell 2001). Knowledge, in turn, will be influenced by information one has. The design of ERP imposes a universal frame of coding and interpreting information as a means of enhancing consistency and efficiency. As such, the information is detached from its context. However, in translating information into knowledge the context is important, since to detach knowledge from its context and conceptualize it in an abstract form might mean that it loses its meaning (Blackler 1995), because of the socially embedded and context dependent nature of knowledge (Nonaka and Konno 1998). Therefore, the distinctiveness of information and knowledge not only suggests different implications and values for organizations, but also suggests that both ERP and KM are needed in order to release and leverage the respective values of information and knowledge.

Context: Intra-organizational vs. Inter-organizational

Despite the fact that both the ERP and KM initiatives aimed to break down formal departmental and divisional boundaries, the implementation of the two systems in the case company led to an unanticipated consequence. The ERP implementation led to an emphasis on measuring physical output across the Production Division. Rather than increase collaboration as intended, this crystallization of individual and departmental performance in the Production Division led to increase internal competition. Consequently, boundaries between different production units were reinforced, even though information flowed freely across units. While the creation of learning and innovation communities could have, to some extent at least, overcome these reinforced boundaries, this did not actually happen in the case company because these communities were consciously organized so that any given community did not have representation from more than one production unit. This was a political decision invoked with a view to reducing conflict. As a result, however, both the ERP and KM initiatives helped to create a new boundary layer within the Production Division. This impeded, to some extent, the sought after knowledge sharing and creation across the Division (Nonaka and Konno 1998). In this instance then, the ERP and KM initiatives were not mutually supportive. Rather they both reinforced the creation of boundaries within the Production Division.

Within the inter-organizational context, one of the key issues emerging from the analysis was the change of relationships with suppliers and service providers. Following the adoption of ERP and the strategic consideration of cost-reduction, the number of suppliers and service providers was drastically reduced, removing in particular those with whom the case company had small and infrequent transactions. There were benefits from consolidating purchasing power and improving supply-chain management through having fewer suppliers and service providers (e.g. Anderson et al. 1997). At the same time, however, relationships with some smaller suppliers and service providers had been vital since these organizations had been actively involved in developing new products. With the reduction in the number of suppliers, relationships with these smaller suppliers had been terminated, thus curtailing their participation in new product development.
Processes: Task-related vs. Social

In terms of task-related processes, the findings suggest that the implementation of ERP had drastically improved the time to produce and gather critical information for strategic decision-making, in particular related to financial performance and productivity on a global scale (Davenport 1998). In addition, the implementation of KM was found to be a useful starting point to facilitate the effective and systematic exploitation of knowledge (March 1991), both intra- and inter-organizationally, and improve continuous learning from past actions (Fiol and Lyles 1985).

One question that emerged was whether the improvement of organizational processes, particularly task-related ones, resulted from the implementation of ERP or KM, or a combination of the two. Extending the previous discussion on the orientation and focus of ERP and KM, it is clear that each initiative alone would have provided only limited value to Company A. The knowledge-based view of the firm argues that competitiveness depends on the effective integration and management of knowledge (Grant 1996). Conversely, the information processing view suggests that enhancing performance depends on minimizing internal and external uncertainty by improving information flow (Galbraith 1977). While both views have their limitations, these were ameliorated in the case company by the combination of the ERP and KM initiatives.

The examination of the relationship between ERP and KM also suggested that intra- and inter-organizational social process had been altered and reshaped through the implementation of the two initiatives. This change was evident in the occurrence of intergroup conflicts, resulting from the shift in information ownership. It was found that converting engineering and R&D information into the format necessary for the ERP system had shifted information ownership to the production division. This occurred because there was no system available which could perform a two-way translation between information produced by the Engineering and Production Divisions and between ERP and other systems, such as the product data management (PDM) system. In other words, information produced by the Engineering and R&D Divisions was made available to the Production Division through ERP, but not from the Production Division to others. Resistance to the loss of information ownership, has been observed in other empirical observations of organizational change (e.g. Nadler 1981). In Company A resistance was evident on the part of the engineers in their reluctance to get involved in, and indeed total disengagement from, attempts to encourage their sharing and integration of knowledge. This problem underpins the fact that an unbalanced power distribution between divisions can lead to a breakdown in the social process (Pfeffer 1981), thus hampering the flow of knowledge across functions (Brass and Burkardt 1993).

Moreover, the alteration of inter-organizational social processes was evident in the change in the landscape of social networks. Referring to the earlier example, the reduction in the number of suppliers and service providers led to the loss of some valuable “social capital” (Nahapiet and Ghoshal 1998), which had been developed over time. According to Nahapiet and Ghoshal, social capital is vital for knowledge sharing within and across social networks, and critical to the creation of new knowledge. From the above discussion, it is clear that ERP, in contrast with KM, had tended to focus on task-related processes and ignored the soft issues – the social processes. Such an oversight also reflects the current theoretical development of ERP and its narrow focus on organizational efficiency and productivity.

Organizational Efficiency and Flexibility

Moving beyond the tradeoff between efficiency and flexibility, Adler et al. (1999, p.50), based on an empirical study of Toyota’s production system, suggest four mechanisms that can allow a company to be both efficient and flexible: metaroutines, enrichment, switching and partitioning. According to them, metaroutines, defined as “standardized procedures for changing existing routines and for creating new ones”, are vital for enhancing the efficiency of nonroutine operations. The concept of enrichment underpins a learning mechanism by which nonroutine tasks are continuously integrated and embedded into standardized activities. Switching refers to the process whereby employees sequentially perform routine and then non-routine tasks. Partitioning suggests the creation of organization subgroups that “specialize in routine or in nonroutine tasks”.

It is possible to consider how the ERP and KM initiatives in Company A impacted on these mechanisms. In terms of metaroutines, both ERP and KM appeared to promote the enactment of metaroutines. The adoption of ERP had led the company to standardize the activities of information processing and management. More critically, new organizational processes were designed and implemented to maximize the potential of ERP (Taylor 1998). Similar arguments can be employed to conceptualize the role of KM, since this allowed the company to systematically externalize and codify knowledge, thereby acting as a catalyst for innovation (von Krogh et al. 2000).

In terms of enrichment, the design and orientation of the ERP system had tended to inhibit this process. This was because it encouraged the dependence on pre-defined and pre-selected routines. The ERP system assumed routine activities and did not take into account the occurrence of nonroutine activities. In other words, ERP was installed to maximize organizational efficiency at the cost of flexibility. However, the KM initiative encouraged new knowledge generated by the learning and innovation communities to be further applied in different tasks. In particular, various pilot teams, based on the learning communities, were
formed as pioneers for process and product innovation. This suggests that the KM initiative in Company A was critical, particularly in complementing the limitation of ERP and embedding nonroutine tasks into existing organizational routines.

ERP’s strong emphasis on efficiency was further evident in its impact on the phenomenon of switching. Within the Production Division, for instance, where the impact of ERP was observed, there was a large proportion of standardized activities and very little if any evidence of switching. Switching did occur occasionally, in particular through involvement in training and participation in learning and innovation communities. However, the target audience for the training courses were primarily poor performers. In other words, individuals and units that had achieved the production standard and target were excluded from the switching activities. So, switching in Company A did not encourage anything other than a reinforcement of the standardized activities. In contrast, tasks performed by the Consultancy Division were highly diverse and non-routinized, coinciding with other empirical accounts (e.g. Fincham 1999). Yet, even here there was limited evidence of switching. The tasks performed in the Consultancy Division demanded high levels of flexibility. Efficiency was much less relevant. So individuals in this Division were almost exclusively involved in nonroutine tasks, and rarely switched to routine tasks. The fact that little switching occurred in either Division suggests a contingency account is necessary, with different types of tasks requiring different organizational structures (Burns and Stalker 1961). In this sense the ERP system had encouraged partitioning, with different Divisions specializing in either routine or non-routine tasks. So efficiency and flexibility were achieved simultaneously by different Divisions specializing in one or the other of these processes, rather than each Division being involved in both.

Conclusion and Implications

This paper has explored the simultaneous implementation of two contemporary managerial systems, ERP and KM, and their combined influence on organizational efficiency and flexibility. The analysis of the content, context and process of ERP and KM has suggested that the two systems can provide complementary outcomes. However, such a synergetic outcome can only be created and developed when the design of task-related processes fits into the metaroutines imposed by ERP and KM, and the social processes are nurtured within functions and cross-functionally. Particularly, nurturing such social processes will largely depend on how information and knowledge ownership can be differentiated and how the landscape of the social network can be reshaped.

In addition to the theoretical contribution, this study has identified and explored a number of important issues from a practitioner viewpoint. For organizations planning to adopt and implement ERP and KM, it is critical to consider the different orientations and foci associated with each initiative. More importantly, it would be judicious to evaluate and prioritize the co-relation between organizational efficiency and flexibility that will fit the design and long-term development of the organization. Again, the significance of social capital and social networks should not be underestimated here.

In relation to the growing need for organizational revitalization and transformation, future research could usefully place emphasis on broadening our understanding of how different initiatives can be integrated and how different approaches to integrating these initiatives can maximize their potentials and leverage competitiveness. Furthermore, future research could critically evaluate how different organizational initiatives can be prioritized to avoid potential innovation overload.

References


