A Model for Analyzing Organizational Performance of ERP Systems from a Resource-Based View

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Abstract

One of the controversial discussions on IT value has been the commoditization of information technology due to its ubiquity (non-proprietary) in the business world. Packaged ERP software with its standard processes has inevitably become the representative one. The risk of losing competitive advantages with the embedded ERP processes was noted. Due to the large amount of resources invested, ERP user organizations require payoff in not only the internal operation but also the competitive market. The capability of managing organizational processes and human capital to take advantage of the knowledge-embedded software seems to be the key differentiator. This study applies a resource-based view in synthesizing research findings about ERP value and building a model for analyzing the process of ERP value generation. Three sets of propositions are formed (1) IT and non-IT resources that are complementary to ERP resources can create economic value and temporary competitive advantages for the user organization; (2) the rare and inimitable organizational resources that are complementary to ERP resources can create a sustained competitive advantage to the user organization; (3) the organizational resources of the trading partners can shape the focal firm’s ability to generate value from the ERP system. The resource-based view helps the explanation of business concerns about homogeneity and resource allocation. It is hopeful that the proposed model could provide a structured analysis of the impacts of various ERP management initiatives and contribute to the study of the competitive value of packaged applications.

Keywords: ERP system value, resource-based view, ERP competitive advantage, ERP, organizational performance, IT value

Introduction

ERP systems have been applied by many firms around the world as a key part of the organizational infrastructure. These systems tend to have a long life cycle in organizational use, and their processes have been extended into external organizations across the industry value chain. Various impacts were reported in different levels of organizational practice such as operational gains, effective decision-making, and increased competitiveness. Different resources were also applied for achieving success in the different stages of ERP implementation and utilization such as top management support, IT infrastructure management, change management and continuous learning. But limited research has linked these management factors to the long –term business performance. The lack of precise understanding of the impact of these ERP success-affecting factors has lead to difficulty in exploiting the valuable organizational resources in the lasting ERP life.

This study applies a resource-based view in synthesizing research findings about ERP value. Extended from an integrative model of IT business value by Melville et al. (2004) a model of ERP value is built and three sets of propositions are formed. The aim is to build a clear
understanding of the interrelationship between the effective management of organizational resources and performance of different levels.

The resource-based view of IT business value
The resource-based view combines the rationale of economics with a management perspective. This theory considers the firm as a collection of resources. The capability to deploy groups of resources (Teece et al. 1997) is the key for management success. Sustained competitive advantage comes from (1) complementarily of resources in creating heterogeneity of efficiency in industry and (2) value, rareness, inimitability and non-substitutability of the complementary resources (Barney 1991). The organizational resources include routines (Nelson and Winter 1982), culture, invisible assets (Itami 1987), human resources, and information technology (Bharadwaj 2000). The speed of accumulation and assimilation of resources is the key to firm growth, as are opportunities arising from underutilization of its resources. Firms continually search for new ways to increase productivity and efficiency. New knowledge yields new ways of using existing resources or new ways of combining sets of resources.

The resource-based view theory informs understanding of the linkage between the type of IT and the nature of business process and organizational performance impacts. Due to its focus on resource attributes and its usefulness in examining the IT resource, we choose resource-based view of the firm as the primary theoretical foundation (Melville et al. 2004).

Grounded in the resource-based view, Melville et al. (2004) built an integrative model of IT business value. The model defines IT business value as the organizational performance impacts of information technology at both the intermediate process level and the organization-wide level, comprising both efficiency impacts and competitive impacts. It is built upon accumulated IT value knowledge spanning a wide range of theoretical paradigms and research methods. 202 articles about IT value in leading journals and conference proceedings between 1992 and 2002 were reviewed and the locus of IT value was divided into three domains: focal firm, competitive environment and macro environment.

ERP value model
Extended from Melville’s et al. (2004) integrative model of IT value a model of ERP value is built by synthesizing major findings of ERP value. The ERP literature reviewed are from major journals and conference proceedings of the past eight years. As depicted in the following figure, the focus of this study is on the ERP business value generated in the focal firm. The macro and competitive environment are not examined in this study due to the risk of losing focus in the complicated research process.

Technological IT resources (TIR)
The technological IT resources include two sets:
1. IT infrastructure: an IT infrastructure provides the shared foundation of IT capability for building business applications and is usually managed by the information systems (IS) group (Broadbent and Weill 1997). The physical IT assets which form the core of a firm’s overall IT infrastructure comprise the computer and communication technologies and the shareable technical platforms and databases.
2. Business applications that utilize the infrastructure: the business applications, such as order entry, purchasing, sales analysis, production, and finance accounting systems, which actually perform the business processes and utilize the shared infrastructure services.
**Human IT resources (HIR)**
The human IT resources generally comprise the training, experience, relationships, and insights of its employees. The critical dimensions of human IT resources include:

1. Technical IT skills, such as programming, systems analysis and design, and competencies in emerging technologies. Legacy system management is an additional skill for ERP project (Holland and Light 2002).

2. Managerial IT skills, which include abilities such as the effective management of IS functions, coordination and interaction with user community, and project management and leadership skills (Bharadwaj 2000).

**Project management**
Project management should be disciplined with timeliness of project and the forcing of timely decisions managed (Holland and Light 2002; Sumner 2000); schedule and budget maintained; training coordinated and proper resources allocated. A strong project leader to gather strong core teams consisted of knowledgeable and skilled IT specialists to overcome knowledge barriers of configuration and assimilation is necessary so that changes during the project are addressed appropriately to respond to environmental and strategic changes at more tactical levels (Umble et al. 2003; Scott and Vessey 2000).

**Vendor support**
Vendor support represents an important factor with any packaged software including extended technical assistance, emergency maintenance, updates, and special user training.

**Business plan and vision**
ERP implementations require that key people throughout the organization create a clear, compelling vision of how the company should operate in order to satisfy customers, empower employees, and facilitate suppliers (Umble et al. 2003; Scott and Vessey 2000).

**Inter-process cooperation and communication**
ERP potential cannot be leveraged without strong coordination of effort and goals across business and IT personnel. A key factor for the successful implementation of ERP systems requires a corporate culture that emphasizes the value of sharing common goals over individual pursuits and the value of trust between process owners, managers, partners,
employees, and corporations. Management of communication, education and expectations are critical throughout the organization (Sumner 2000).

**Business process reengineering**
One of the problems associated with implementing packaged software is the incompatibility of features with the organization’s information needs and business processes. It’s almost inevitable that business processes are molded to fit the new system (Ross et al. 2002).

**Change management**
Managing change is a primary concern of many involved in ERP implementations (Robey et al. 2002; Markus et al. 2000). ERP systems introduce large-scale change that can cause resistance, confusion, redundancies, and errors.

**Complementary organizational resources**
Successful implementation of IT is usually accompanied by organizational change, including policies and rules, organizational structure, workplace practices, and organizational culture, etc. When IT resources and other resources exist in the firm, the latter resources are called complementary organizational resources (Melville et al. 2004; Barney 1991). Complementary resources are resources that either supply mutual needs or offset mutual lacks of the implementation of the ERP systems. They include: top management support, external expertise, management, structure, and organizational culture.

**Top management support**
Successful ERP implementations require strong leadership, commitment, and participation by top management (Holland and Light 2002; Parr and Shanks 2002). The roles of top management in ERP implementations include developing an understanding of the capabilities and limitations of ERP, establishing reasonable goals for ERP systems, exhibiting strong commitment to the successful introduction of ERP, and communicating the corporate ERP strategy to all employees.

**External expertise**
Different consultants may have experience in specific industries, comprehensive knowledge about certain modules, and may be better able to determine which suite will work best for a given firm (Holland and Light 2002; Sumner 2000). A close working relationship between the project team and consultant is needed throughout the implementation phases.

**Management structure**
The management structure relates to: the resource control structure, the reporting structure, the distribution of authority, the job responsibilities and measurements of the organizational and individual performance. They all need to be aligned with the new ERP processes so that information can flow smoothly, decisions can be made properly, problems can be solved efficiently, active improvements can be motivated, and cooperative behaviors can be guided (Somers and Nelson 2001; Sumner 2000).

**Organizational culture**
In the ERP system life, enterprise-wide culture should be managed for an effective use of the system. A culture with shared values and common aims is conducive to success. An emphasis on open to change, continuous improvement mind-set in the firms (Ross et al. 2002) and a strong commitment to use the system for achieving business aims (McCredie and Updegrove 1999) would aid in implementation efforts.
ERP implementation and use
ERP implementation refers to the stage of system planning, configuration, testing and final implementation. ERP use means ERP adoption or utilization. It refers to the experience of managing the operation of the system software in throughout the system life in the post-implementation stages (Nah et al. 2004).

Organizational performance
Organizational performance is the aggregation of ERP-enabled process improvements with metrics capturing bottom-line firm impacts (Melville et al. 2004). After reviewing studies on the impact of ERP systems on business performance (Shang and Seddon 2002; Markus et al. 2000), one would expect a wide range of influences from ERP ranging from operational to strategic. Operational efficiency is usually reflected in cost reduction and productivity enhancement whereas strategic success is usually reflected in revenue growth and gains in market share. It is important to note that changes in organizational resources may not result in immediate success due to adjustment costs, learning and other factors. Benefits of ERP systems require longitudinal review of the organizational performance.

Propositions about ERP value generation
Based on the concept of resource-based view that the complementarity and inimitability of organizational resources can lead to operational and strategic benefits we form the following propositions about the development of ERP operational and strategic benefits.

Proposition 1A. The greater the capability of the IT infrastructure for ERP software implementation the greater the degree to which the ERP user organization can obtain operational benefits
Many ERP systems replace old, obscurely coded, disparate applications running on proprietary operating systems with modern, integrated systems built upon relational databases. New applications usually require a great deal of tuning to meet performance expectations. A properly supported IT infrastructure can provide the level of performance users expect from a modern enterprise application (McCredie and Updegrove 1999).

Proposition 1B. The greater the functionality fit of the ERP software to the organizational objectives the greater the degree to which the ERP user organization can obtain operational benefits
To achieve the greatest benefits provided by an ERP system, it is imperative that the business processes are aligned with the ERP system (Holland and Light 2002). One way of ERP implementation is to impose ERP logic on a company’s strategy, culture, and organization without any customization (Davenport 1998). The secondary way is using ERP software configuration or ERP tailoring options, and it is easier to mold the organization to the ERP software than reverse situation. The last way is using customization. Management has the ultimate choice of changing the process to fit the system or the system to fit the process.

Proposition 1C. The greater the degree of complementarity between the human IT expertise and technological IT resources in an ERP implementation the greater the degree to which the ERP user organization can obtain temporary competitive advantages.
ERP implementation success or failure is related to the knowledge, skills, abilities, and experience of the project manager as well as selection of the right team members, which should not only be technologically competent but also understand the company and its business requirements. The skills and knowledge of the project team is important as is the
management of vendors to provide expertise in areas where team members lack knowledge (Ross et al. 2002). Organizations need to establish clear IT government structure and capability so that internal and external resources are well utilized for creating temporary competitive advantages with the ERP systems.

**Proposition 2A. The greater the degree of complementarity between the organizational resources and ERP software implementation and use the greater the degree to which the ERP user organization can obtain benefits of all dimensions.**

Complementary organizational resources interact with IT in the process of value generation (Melville et al. 2004). Prior researches (Bresnahan et al. 2002; Brynjolfsson and Hitt 2000) indicated that a change in either the organizational thinking or the management structures accompanied by appropriate IT investment lead to improved and transformed business processes and competitive advantage. The organizational resources including top management insights, reporting structure, job responsibilities, and shared visions are important factors for achieving benefits of all areas in the phase of ERP use.

**Proposition 2B. The greater the inimitability of rare organizational resources that are complementary to the use of ERP software and lacking substitutes, the greater the degree to which the ERP user organization can obtain a sustained competitive advantage.**

Complementary organizational assets are valuable and may be rare. When there are no strategic equivalents, sustained competitive advantage rests on the extent to which such resources are imitable (Melville et al. 2004). What makes a business resource truly strategic is not ubiquity but scarcity (Carr 2003). Edges are gained over rivals only by having or doing something that others cannot have or do. The functions of ERP systems have become available and affordable what is crucial is to be able to distinguish the commodity resources from resources that do have the potential to create advantage.

**Conclusion**

Although the propositions are yet to be tested several preliminary findings are worthy. First, ERP user organizations not only need to assess the capability of the IT infrastructure and human skills but also need to assure the complementarity among these resources. Second, ERP user organizations would need to invest appropriate organizational resources in supporting effective system use. Third, competitive advantage can be temporary if the coordinated resources are not institutionalized, only an embedded and combined organizational capability for managing continual changes with ERP systems can achieve lasting competitive advantages. Finally, ERP success, nowadays, also relies on the connected partners’ capability in managing their processes and resources; the focal firm would need to be able to assess risks in trading partner’s corporation model.

Based on the resource-based view this study synthesizes previous knowledge of ERP value and proposes a model of ERP value in the competitive environment. This model provides a framework for examining business efforts in the IT hardware, software, human capability and related organizational resources. The resource-based view helps the explanation of business concerns about homogeneity and resource allocation. It is hopeful that the proposed model could enhance the understanding of the impacts of various ERP management initiatives and contribute to the study of the competitive value of packaged applications.

**References**