Int. J. Production Economics 119 (2009) 259–270

Contents lists available at ScienceDirect

Int. J. Production Economics

journal homepage: www.elsevier.com/locate/ijpe

Supporting the module sequencing decision in the ERP implementation process—An application of the ANP method

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ARTICLE INFO

Article history:
Received 20 March 2008
Accepted 9 March 2009
Available online 5 April 2009

Keywords:
Enterprise resource planning (ERP)
ERP implementation
ERP module implementation

ABSTRACT

The paper addresses the alignment between business processes and information technology in enterprise resource planning (ERP) implementation. More specifically, we concentrate on one of the key decisions at the tactical alignment level: the decision on the implementation sequence of the ERP modules. Since the module sequencing problem involves a myriad of organizational and technical issues, connected to each other in networked manner, the analytic network process (ANP) methodology is applied. As a result of the study, we present first a general level conceptual framework to sequence ERP module implementations and expand the model to a more detailed level in a case study. The priorities for the implementation sequence of the ERP modules are determined in the case study.

1. Introduction

Contemporary organizations operate in a global environment that is characterized by constant change and different cultural settings. To avoid the fragmentation of the operational data in different business units, companies implement enterprise wide information systems, such as ERP (enterprise resource planning) systems that can increase control, improve coordination and communication, and create the picture about the corporate functions on the aggregate level. Typically, ERP-systems support financials, human resources, operations and logistics, and sales and marketing functions (Davenport, 1998).

The objective of ERP systems is to conduct the business processes more efficiently and effectively, in an integrated manner. They are a way to control functions of the organization and to make all the units perform in a more uniform way. Dramatic operational improvements are possible, through integration and redesigning of processes. It is assumed that the standard software package more or less fits all organizations, and all units inside one organization, which creates risks for ERP investments.

In theory, business processes are modified to fit the systems, since customizing the system is considered too expensive and too risky. But in practice both business processes and ERP systems are suspects to be changed during the implementation process. The technical nature of ERP software is already quite well described and known (see, for example, Klaus et al., 2000), but because of the ERP implementation related context-sensitive social diversity is huge, the perceived results and outcomes of ERP implementation vary a lot (Ross and Vitale, 2002; Scott and Vessey, 2000). There are a lot of problems reported in the implementation of these systems, and even the objectives of the system investments may evolve during the process (Glover et al., 1999; Nandhakumar et al., 2003; Themistocleous et al., 2001). Technology and the organization are in a continuous interaction with each

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doi:10.1016/j.ijpe.2009.03.008

other during technology adoption and use, according to Orlikowski (1992). The alignment between business and IT is a dynamic process with bi-directional interaction.

The decisions affecting the alignment of the business and IT are made on strategic, tactical and operational levels (Hendrickx, 2002). The strategic decisions concerning ERP projects include, for example, which modules are implemented and how much business process re-engineering is conducted (Parr and Shanks, 2000; Mabert et al., 2003). The decisions on issues, such as, using internal or external resources for implementation and in which order the modules are implemented can be considered tactical in nature. Finally, the operational decisions are those concrete decisions affecting daily workflows.

The implementation of ERP software packages necessitates disruptive organizational change (Soh et al., 2000) and that's why there are considerable risks involved. When the problems surface they require countermeasures that require resources and time, such as providing more personnel training when the ERP implementation introduces significant changes in workflows. The risks and misfits between the organization and technology should be identified early for planning the change management issues (Soh et al., 2000, 2003). The scope of decisions that a company can make becomes smaller when the implementation process approaches actual operational implementation. The implementation can be conducted either as "big bang" or as phased implementation by site or by module (Mabert et al., 2000).

This paper studies the alignment of business and IT in a case where it was decided to phase the implementation by the ERP modules. A survey investigating companies in the United States reported that about 17% of organizations in their sample phased the ERP implementation by modules (Mabert et al., 2000), indicating that phasing the implementation by modules is rather common. Thus, the module sequencing decision can be considered as a relevant research problem. The aim of this paper is to provide the analytical means to analyze the investment parameters, including the risks, before the actual implementation starts, and based on the analysis to decide on the implementation sequence of the ERP modules. The implementation of some modules may need to be postponed, because the identified risks require time consuming countermeasures, whereas other modules may need to be implemented as soon as possible, because, for example, the legacy system is not working properly and has to be replaced. For some monolith and rigid ERP packages this module sequencing decision may be driven by technical imperatives, but more flexible technologies and service-oriented architectures will call for social negotiation to decide optimal sequence for available ERP modules and services.

Since the decision problem of the module sequence involves a myriad of organizational and technical issues, which are interconnected in networked manner, we propose the analytic network process (ANP) method (Saaty, 2001; Saaty and Özdemir, 2005) to be applied. The ANP methodology includes defining the decision-making criteria and their interrelationships as well as the decision alternatives. ANP methodology supports complex, networked decision-making with various intangible criteria. It improves the visibility of the decision-making process and generates the priorities between the decision alternatives. ANP has been applied to a variety of decision problems, including, for example, allocating proper service concepts to the different IT market segments (Partovi, 2001), investment evaluation (Kengpol and O'Brien, 2000), evaluating componentized Enterprise Information Technologies (Sarkis and Sundarraj, 2003), ERP systems evaluation (Shyur, 2003), and R&D project selection (Meade and Presley, 2002).

The application of the ANP methodology requires, first, developing the general level conceptual framework and, second, developing the framework at the detailed level for applying it in an actual case. In the next two sections we review the literature on ERP implementation and business and IT alignment to provide the conceptual foundations for the paper. Section 3 also describes the principles of the ANP method and defines the focus of analysis in the paper. Section 4 presents the results of the case study. Finally, section five discusses the results and conclusions of this paper.

2. ERP implementation process

ERP systems automate and integrate an organization's business processes and allow data and information sharing across the different business functions. ERP implementation is an organizational, economic, and technical challenge. ERP implementation requires substantial business process changes at strategic, tactical as well as operational levels. ERP implementation is usually an extensive and costly process that takes time even years and many companies experience serious problems during the implementation process.

Because ERP implementation is both an organizational change process and an IT implementation process, the general models of organizational change and the general models of IT implementation process can be applied to the planning, execution, and evaluation of the ERP implementation. In the Lewin–Schein theory of change any organizational change can be viewed as a three-step process consisting of unfreezing, moving (or changing), and refreezing phases (Lewin, 1952; Schein, 1961). Unfreezing increases the receptivity of the client system to a possible change in the distribution and balance of social forces. Changing, or moving, alters the magnitude, direction, or number of driving and resisting forces, consequently shifting the equilibrium to a new level. Refreezing reinforces the new distribution of forces, thereby maintaining and stabilizing the new social equilibrium. Kwon and Zmud (1987) elaborated Lewin–-Shein theory of change in their six-phase implementation model as described in Fig. 1.

As a response to the implementation problems with ERP systems, a number of factor and process models have been proposed to moderate these problems. The factor models describe an extensive set of risk factors as well as critical success factors for ERP implementation projects