

A neural network evaluation model for ERP performance from SCM perspective to enhance enterprise competitive advantage

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Abstract

Due to increasing global competition, many enterprises are aware of the benefits of Enterprise Resource Planning (ERP). While the external environments and alliance partnerships facing an enterprise are becoming more complex, executives should consider appropriate partners to enhance efficiency and performance of supply chain management (SCM) as well as to gain potential competitive advantages. This study constructs a conceptual model to evaluate the performance and competitive advantages associated with ERP from a SCM perspective. The resulting model can be used to assist an enterprise in evaluating the potential partnerships. The survey data was gathered from a transnational textile firm in Taiwan. The training and learning models were based on the strategic thrust theory and used the Back-Propagation Network (BPN) as an evaluation tool.

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Keywords: Enterprise Resource Planning (ERP); Supply chain management (SCM); Strategic thrust theory; Back-Propagation Network (BPN)

1. Introduction

The internal information systems of a traditional organization are usually orientated on a functional basis. This set-up does not encourage efficient departmental communication within the firm. Traditional information systems do not satisfy the information requirements of global logistic trends. Recently, there has been an emphasis on integrating a company's internal and external activities to improve a firm's competitive edge. This approach, when applied to the development of integrated information systems, has become a major thrust. Davenport (1998) stated that an integrated information system is a smart tool that can be

used by a firm to solve problems associated with widely distributed information sources.

Enterprise Resource Planning (ERP) systems can integrate a firm's internal information from a financial perspective, allowing finance, accounting, purchasing and other departments to acquire information in a timely manner. ERP emphasizes integration of the flow of information relating to the major functions of the firm. The broader and more complex the organization is, the more it requires integrating this information flow. When applying supply chain management (SCM), orders can be forecasted efficiently and correctly, stock costs for supply chain partners can be reduced, and a manufacturing schedule can be set to optimize manufacturing and supply time. Additionally, strategic alliance was developed to facilitate collaboration between firms (Forrest & Martin, 1992). It plays an important role in establishing a firm's competitive advantage (Bowersox, 1990). SCM emphasizes close collaboration between supply chain partners and the building of a strong

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alliance in their joint strategic business focus. Therefore, SCM and a firm's competitive advantage are closely linked.

Integrating SCM to an ERP system can facilitate information flow in the supply chain so that partners of the chain can streamline their operations and share information sources to provide timely and accurate services to their customers. Traditional methods to evaluate ERP performance are limited to the internal departments of the company and do not include supply chain partners. However, under the global competition, many companies strengthen their core competencies via selecting their good business partners (Hong, Park, Jang, & Rho, 2005). Moreover, Choy, Lee, and Lo (2003) suggest that improving supply chain execution is important for achieving a firm's competitive advantage. Shin, Collier, and Wilson (2000) emphasized that a firm's performance can be evaluated by one or more key competitive priorities. Therefore, the five strategic forces of the strategic thrust theory can be independent or linked (Wiseman, 1985), and may relate to SCM performance.

This study uses a case to construct a conceptual model for the performance evaluation of an extended ERP system from an SCM perspective. The Back-Propagation Network (BPN) is used as a tool to access tacit knowledge held by the firm's employees and the ERP consultants. This knowledge can be used to evaluate the extended ERP systems that conform to the SCM performances. The goals of this paper are as follows:

- (1) To access the tacit knowledge inherent in the case firm's employees and its ERP consultants/experts through the model learning process.
- (2) To construct a BPN model to support a firm in evaluating its extended ERP performance from an SCM perspective and to test the competitive advantages gained by the ERP system.
- (3) To produce results that will be useful to a firm when selecting partners.

2. Literature review

2.1. Strategic thrust theory

Porter (1985) used a value chain to analyze the operations of firms in reaching global optimization by coordinating activities. Porter identified five key forces that enable a firm to establish a long-term competitive advantage. His "Five Forces Theory" comprises of the bargaining power of suppliers; the bargaining power of buyers; the potential threat of new entrants; the threat of substitute products or services; and rivalry among existing firms.

Wiseman (1984) proposed a Strategic Thrust Theory to assist firms in planning and implementing a strategic information system to gain competitive advantages. The initial Strategic Thrust Theory included differentiation, cost,

and innovation (Wiseman, 1984). Wiseman (1985) further broadened the scope of Porter's model, by considering the firm's competitive advantages as dominant over all one's competitors and that can be sustained over a period of time. The scope then was expanded to five postulates (Rackoff, Wiseman, & Ullrich, 1985; Wiseman, 1985) that constitute the major competitive aspects of a firm. The five postulates include differentiation, cost, innovation, growth, and alliance.

2.2. Extended enterprise resource planning (EERP)

Regarding the definition of ERP, some literature states that an ERP system is a package to integrate a firm's internal information systems (Bylinsky, 1999; Davenport, 1998; Laughlin, 1999). The American Production & Inventory Control Society (APICS) defined an ERP system as a financial and accounting oriented information system. Its major functions are the integration and planning of resources including purchasing, production, distribution, performance and reduction of business costs (APICS, 1998). Meanwhile, Tam, Yen, and Beaumont (2002) added human resources as basic functions of ERP. Furthermore, Davenport (1998) separated ERP into four function scopes: finance, human resources, operations logistics and sales and marketing. These four functional models are further divided into 29 sub-functions.

Although there are many definitions of ERP, the functional models developed by various software companies are similar. Most firms contemplating an ERP system focus on the integration of internal resources, but do not consider the competitive environment of global logistics. In order to maximize a firm's competitive advantage, ERP systems should be extended to cooperatively plan and operate with all partners in the supply chain (Akkermans, Bogerd, Yucusan, & van Wassenhove, 2003). Vickery, Calantone, and Droge (1999) proposed supply chain levels that span the value delivery cycles of the manufacturer, its suppliers and its downstream channel members. Ellram (1991) argued that SCM systems should manage the integration of material planning and control that flows both ways from suppliers to end consumers. The extended ERP system seeks to enhance the competitive performance of a firm by closely integrating the internal functions and effectively linking them with the external operations of suppliers and channel members.

After analyzing the relationship between SCM and ERP from both the global business and technology perspectives, Tam et al. (2002) pointed out that there is a demand for the integration of SCM and ERP. They also compared the differences between ERP and SCM systems, and emphasized that extended ERP systems compel firms to provide a communication and information flow among supply chain agents, thus overcoming natural boundaries. The integration of ERP and SCM systems is a natural and necessary process offered for strategic and managerial consideration (Tarn, Razi, Yen, & Xu, 2002). Such extended ERP system

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