



Production, Manufacturing and Logistics

Why are enterprise resource planning systems indispensable to supply chain management?

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ABSTRACT

Supply chain design is becoming a core competency, and the enterprise resource planning (ERP) system is expected to be an integral component of supply chain management (SCM). Installing an ERP system is, however, expensive and risky. IT managers must decide how to use their limited resources and invest in the right product. Can an ERP system directly improve SCM competency? This study proposes a conceptual framework featuring the ERP benefits and SCM competencies, and examines the impacts of the former on the latter. The results confirm the operational, managerial, and strategic benefits of ERP for the SCM competencies, but not the IT infrastructure and organizational benefits as significant predictors of them. Moreover, more than 80% of respondents think it necessary to first adopt an ERP system as the backbone of company operations before deploying other enterprise systems (ES), such as the SCM system.

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1. Introduction

The globalization of competition means that apart from ensuring their own successful operation, firms that hope to survive must establish highly responsive supply chains, with up-, mid-, and downstream partners. How to best improve corporate SCM capabilities in order to improve overall supply chain performance has therefore become an important issue in corporate management (Park et al., 2005; Whit et al., 2005). As Kuei et al. (2002) have pointed out, SCM is a network of autonomous or semi-autonomous business entities collectively responsible for procurement, manufacturing and distribution activities associated with one or more families of related products. Enterprises in the supply chain are likely to increase control over their suppliers and enhance their SCM competencies by gaining power from information. To meet these new challenges and the need for a competent supply chain, companies around the world have invested heavily in Information Technology (IT), and take advantage of IT systems to radically alter the conduct of business in both domestic and global markets. In particular, many firms have implemented company-wide systems called ERP systems, which are designed to integrate and optimize various business processes, such as order entry and production planning, across the entire firm (Mabert et al., 2001). This invest-

ment has also made possible the sharing of large amounts of information along the supply chain, and has enabled real-time collaboration between supply chain partners, providing organizations with forward visibility, thus improving inventory management and distribution. ERP, which allows for the transmission and processing of information necessary for synchronous decision making, can be viewed as an essential enabler of SCM competencies (Akkermans et al., 2003; Hsu et al., 2009; Sanders, 2007). Furthermore, many firms deploying ERP systems considered extending system scope mainly to integrate their suppliers, customers or both to the system, to provide additional e-commerce or e-business operations and to increase supply chain functionalities (Olhanger and Selldin, 2003).

When ERP systems are fully realized in a business organization, they can be expected to yield many benefits, such as reduction of cycle time, faster transactions, better financial management, the laying of the groundwork for e-commerce, linking the entire organization together seamlessly, providing instantaneous information, and making tacit knowledge explicit (Mabert et al., 2001; Davenport and Brooks, 2004; Shang and Seddon, 2000; Murphy and Simon, 2002; Al-Mashari et al., 2003). ERP can provide the digital nervous system and the backbone in an organization to respond swiftly to customers and suppliers (Cox et al., 2000; Mabert et al., 2001). As reported in Akkermans et al. (2003), ERP systems are widely believed to contribute to SCM in technical areas such as standardization, transparency and globalization. ERP systems are a leading tool for this purpose, and are always expected to be an integral component of SCM (Nah et al., 2001; Themistocleous

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et al., 2004). The potential benefits of an integrated ERP system are such that many organizations are willing to undertake the difficult process of conversion.

Adopting an integrated ERP system, however, has mixed results in terms of a firm's performance, and some academic research is much more suspicious of its benefits. First of all, implementing an ERP system is costly and risky; it requires a large amount of capital, and its inflexibility makes it often difficult to implement across all departments within a large corporation (Mabert et al., 2001). Some businesses have invested enormous sums of money in ERP or IT without positive results (Gupta and Kohli, 2006; Ehie and Madsen, 2005; Strassman, 1990).

Hitt et al. (2002), on the other hand, produced multiyear, multi-firm ERP implementation and financial data that shows evidence of short-run gain during implementation, but a lack of post-implementation data at the time they conducted their study meant they were unable to estimate the long-run impact. Gattiker and Goodhue (2004) argued that high interdependence among organizational sub-units contributes to positive ERP-related effects because of ERPs facilitate coordination and information flows. When differentiation among sub-units is high, however, organizations may incur ERP-related compromise or design costs. A survey by Mabert et al. (2003a) found some improvements in managers' perceptions of performance, but that few firms had reduced direct operational costs. In addition, Hendricks et al. (2007) observed improvements only in profitability, not in stock returns. Data for improvements in profitability is also stronger in the case of early adopters of ERP systems. Although their results are not uniformly positive across the different enterprise systems (ES, including ERP, SCM, and CRM systems), they are encouraging in the sense that despite the high implementation costs, they do not find persistent evidence of negative performance associated with ES investments.

More recent evidence has, on the contrary, demonstrated large benefits and uncovered significant productivity gains from IT investments: for example, as reported in McAfee (2002), an in-depth case study of an ERP implementation and its effects on performance at a single firm. This longitudinal research presents initial evidence of a causal link between IT adoption and subsequent improvement in operational performance measures, as well as evidence of the timescale for these benefits. Hunton et al. (2002) experimentally tested the relationship between ERP and performance by presenting 63 certified analysts at a financial services firm with the hypothetical case of a company, and comparing these analysts' initial earning forecasts with their forecasts after they are told that the hypothetical firm has committed to investing in an ERP system. The results show that the revision in earnings is positive, thereby providing supports for the hypothesis that implementation of ERP systems has a positive effect on performance. Huang et al. (2007) proposed an integrated theoretical model that demonstrated that the company's implementation of ERP has a positive effect on the process capital of its Intellectual Capital (IC); the process capital then affects the customer capital, which ultimately translates into business performance.

Many academic researchers have contributed by confirming the relationship between SCM and firm performance (Du, 2007; Closs and Mollenkopf, 2004; Byrd and Davidson, 2003; Gunasekaran et al., 2004) or by confirming the relationship between ERP implementation and firm performance (Hendricks et al., 2007; Mabert et al., 2001, 2003a; McAfee, 2002; Hitt et al., 2002; Gupta and Kohli, 2006; Ehie and Madsen, 2005; Kalling, 2003). Moreover, determining how to integrate various ERP modules into SCM, for planning, control and execution of materials, resources and operations has recently become important (Koh et al., 2006; Samaranyake and Toncich, 2007; Ho, 2007). Research focusing on the relationship between ERP benefits and SCM competencies

is limited and inconclusive (Hsu et al., 2009). Accordingly, the current research addresses this gap in the literature by analyzing the ERP benefits and SCM competencies. The evidence that the Taiwanese IT industry has had a highly successful growth experience with SCM competencies shows that it can be documented, and lessons can be learned.

This article focuses on SCM and ERP issues. First, definitions of those terms are provided, and compared with recent usage. Second, a review of past research on ERP and SCM is presented to illustrate the ERP benefits and SCM competencies. A conceptual research model is proposed. Third, the reasons for collecting data from Taiwanese IT firms through a survey and interviewing of experts are presented. And fourth, the overall proposed model is validated.

2. Literature review

2.1. Supply chain management

The term "supply chain" is used in the present research in the spirit of the value chain concept. A supply chain is a dynamic process and involves the constant flow of information, materials, and funds across multiple functional areas both within and between chain members (Jain et al., 2009). "Supply chain management" as the integration of key business processes among a network of interdependent suppliers, manufacturers, distribution centers, and retailers in order to improve the flow of goods, services, and information from original suppliers to final customers, with the objectives of reducing system-wide costs while maintaining required service levels (Simchi-Levi et al., 2000). Such a holistic approach is consistent with the integrated way today's global business managers are planning and controlling the flow of goods and services to the marketplace.

2.2. Competencies of SCM

The literature on SCM is quite vast and dispersed across many areas. In recent years, supply chain design and its competencies and performance have received much attention from researchers and practitioners. From the RBV viewpoint, all firms have capabilities; however, a firm will usually focus on certain capabilities consistent with its strategy, and the firm's most important capabilities are called competencies (Barney, 1991). Accordingly, competencies emphasize technological and production expertise at a specific point along the value chain (Vickery et al., 1993). Closs and Mollenkopf (2004) proposed a framework that identifies six firm competencies critical for SCM and is based on the work of Bowersox et al. (1999). Each competency is composed of multiple underlying capabilities, which guide philosophies and processes to complete specific logistics and supply chain activities and to overcome obstacles that undermine both internal and external integration of value-added supply chain operations.

2.3. Enterprise resource planning

Different researchers have suggested different ways of defining ERP. One significant feature of an ERP system is that core corporate activities, such as manufacturing, human resources, finance, and supply chain management, are automated, and are improved considerably by incorporating best practices, so as to facilitate greater managerial control, speedy decision making and huge reduction of business operational cost. The definition of ERP used in the present research is as stated by Wallace and Kremzar (2001):

"An enterprise-wide set of management tools that balances demand and supply, containing the ability to link customers

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