

# LEVERAGING DIGITALLY ENABLED SUPPLY CHAIN INTEGRATION CAPABILITIES TO ENHANCE ORGANISATIONAL PERFORMANCE AND COMPETITIVE ADVANTAGE *Development of a Conceptual Model*

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**Keywords:** Supply chain integration, IT infrastructure, Human IT capabilities, Supplier and customer coordination.

**Abstract:** There has been considerable research investigating the impact of IT on supply chain management of organization. The reason for this research is to enable organizations to improve their supply chain networks, thus enhancing overall productivity, performance and competitive advantage. We have attempted to use the Resource Based View (RBV) to develop a conceptual model aimed at investigating the effectiveness of supply chain integration capability of organization.

## 1 INTRODUCTION

Recently the concepts of supply chain design and management have become a popular operations paradigm. This has become more important with the development of information and communication technologies (ICT) that include B2B e-commerce technology and Electronic Data Interchange (EDI). Owing to the ever-increasing complexity of systems driving buyer-supplier relationships, organizations have been compelled to resort to electronic communication systems. Many organizations are increasingly faced with the problem of having to manage not just internal operations and functions, but a broader range of relationships with trading partners. This need has led many to look at implementing technological solutions to enable this process (Power, 2005). For example, the Internet increases the richness of communications through greater interactivity between the firm and the customer (Watson et al., 1998). Internet and web-based technologies have also significantly improved collaboration and integration among supply chain partners permitting strong supplier integration for inventory planning, demand forecasting, and order scheduling (Sanders, 2007). In this paper we have endeavored to develop a conceptual model using the Resource Based View (RBV). This model

incorporates IT infrastructure and human IT capabilities of organisations, which in our view are drivers of total supply chain integration capabilities. The anticipated outcome of enhanced supply chain integration on organisations is superior performance relative to their nearest competitors.

## 2 LITERATURE REVIEW

The development of information and communication technologies provides better information sharing among supply chain members which is vital for close coordination and collaboration in supply chain (Lee, 2000). This implies that information provides linkages amongst members of a supply chain that can be used to orchestrate all activities across the supply chain. The visibility of information to all supply chain members can overcome problems associated with communication, inventory costs, customer service, and utilization of capacity (Croom, 2005; Disney & Towill, 2003). However in achieving this, companies need to invest large amounts of money redesigning internal organizational and technical processes, changing traditional and fundamental product distribution channels, altering customer service procedures and training staff (Motwani et al., 2000). Moreover, it is

important to note that inter-company information sharing among supply chain members involves competitive implications, which emerge because shared information affects the bargaining powers of the business partners. Anecdotal evidence suggests that suppliers fear that the visibility of information between supply chain members will give competitors an open window onto their pricing structures and operational capabilities (Jauhainen et al., 2006)

In recent years, the number of research studies relating to the impact of IT on supply chain relationship and performance is increasing. Related issues have been discussed within an interdisciplinary dialogue linking disciplines such as in marketing (Kim et al., 2006), supply chain management (Sanders, 2005), information systems management (IS) (Rai et al., 2006) and strategic management (Kim & Mahoney, 2006). However, empirical evidence is still fragmented and a comprehensive conceptual framework to integrate different theoretical perspective is lacking in the literature (Gunasekaran & Ngai, 2004; Jean et al., 2008) Particularly, there is limited research evidence on how and why information technology can create competitive advantage and performance gains for firms in a supply chain management context. Jean et al. asserts that although there are some optimistic views of the contribution of IT on business value, yet there are differing views on the impact of IT on organisational performance (Jean et al., 2008). Some authors call this phenomenon the "IT productivity paradox" (Brynjolfsson & Yang, 1996; Lim et al., 2004; Sriram & Stump, 2004). This paradox implies that IT does not necessarily enhance productivity or business performance; in fact, IT may even be viewed as a commodity which can be easily be replicated by competitors (Carr, 2003), and hence diminishes the prospects to develop sustainable competitive advantage. Large scale IT implementation within critical business processes may actually disrupt business efficiency if not undertaken very carefully.

Barney believes that the '*resource based view*' (RBV) is a framework which can potentially be used to enhance our understanding of the effect of IT on a firm's performance (Barney, 1991). He suggests that the performance of organizations can be linked to resources and skills that are firm-specific, rare, and difficult to imitate or substitute. The RBV, presently a dominant theoretical perspective in strategic management literature, focuses on costly-

to-copy attributes of a firm which are seen as the fundamental drivers of performance (Bharadwaj, 2000).

Despite the conceptual work which has been done linking different resource attributes to firm performance and competitive advantage, ambiguity and confusion still exist with the application of RBV to business-value research. For example, it is still not clear how different IT resources interact with other capabilities and business processes to impact firm performance and create competitive advantage. Moreover, although the role of IT is critical in supply chain management (SCM), the theoretical and empirical research related to digitally enabled supply chain integration phenomenon has been limited and piecemeal (Sahin & Powell, 2002). Also there is no comprehensive framework available on the application of IT (particularly in business to business e-commerce) for achieving an effective SCM (Gunasekaran & Ngai, 2004).

### 3 RESEARCH METHODOLOGY

This paper, using the RBV theory, aims to build a conceptual framework which depicts how IT capabilities enhance business performance in supply chain relationships (supply chain integration capabilities). Ultimately we hope to develop the conceptual model from a firm's perspective, exploring holistic electronic channel interaction with its key suppliers and customers in the B2B context. In doing so, we focus on the function of IT supported inter-organisational interaction in supply chain relationships.

Based on our conceptual model, we have developed a survey instrument which is aimed at capture of the perceptions of senior supply chain and/or logistics managers of large organizations. We have obtained in-principle support of a supply chain management professional body which has 15,000 organizational members. The organization promotes a system for the adoption and implementation of electronic commerce (EDI and RFID based technology) and global standard bar coding among their members. Using on-line quantitative survey techniques we intend to obtain data on each operationalized construct within our conceptual model, and on their relationships, guided by the above hypotheses. Data will be analyzed using the structural equation modeling (SEM) technique. All the linkages and

hypotheses associated with our conceptual model will be empirically tested.

## 4 TOWARD A CONCEPTUAL MODEL

As shown in Figure 1 the proposed conceptual framework is rooted in the emergent stream of RBV in IT business value research, as discussed in the previous section. According to the RBV, we argue that firms with specific IT capabilities which are rare, valuable and not easy substitutable can enhance inter-organisational capabilities and processes. Therefore, these inter-organisational capabilities and processes can improve a firm's ability to integrate with its key suppliers and customers. In turn, these processes and capabilities would possibly lead to higher organisational performance. We conceptualise IT capability as infrastructure (technological) and human capabilities, both of which are associated with the ability of a firm to use IT-enabled supply chain technologies in information sharing, process transaction, coordination of activities, and facilitating of collaboration with suppliers and customers. The various constructs and sub-constructs within our conceptual model are now briefly explained.

### 4.1 IT Infrastructure Capability

IT infrastructure integration is conceptualized as a formative construct with three sub constructs: Data consistency, Cross-functional SCM application systems integration (which are related to process oriented integration in SCM) and B2B digital platform (which is related to the use of internet technology by a firm).

#### 4.1.1 Data Consistency

Data consistency is defined as the degree to which common data definitions and consistency in stored data have been established across a focal firm's supply chain. Data consistency in supply chains are enabled by common data definitions for key entities, such as customer and product, as well as automated systems for accurate data capture. This consistency should enable process integration (Huber, 1990; Malone et al., 1987), including the integration of information, financial, and physical flows. Some of the practical examples of data consistency are standard bar-coding systems such as GS1 bar-coding standards, product numbering and EDI.

### 4.1.2 Cross-functional SCM Application Integration

It is defined as the degree of real-time communication of a focal firm's function-specific SCM applications with each other and with related Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) applications. Such connectivity enables the management of cross-functional process dependencies in a supply chain (Rai et al., 2006). Note that application integration is concerned with a firm's ability to interface function specific supply chain applications with each other in real time.

#### 4.1.3 B2B Digital Platform Capability

It is the ability of firm to use internet technologies for sharing information and managing its supply chains. (Devaraj et al., 2007) classified e-Business technologies into three categories depending on their focus. The first category of technologies focuses on the demand side, and relates to allowing customers to order online, configure or customize products online, and check the status of orders online. The second set of technologies focuses on the supply side, and addresses the capability of the company to find and select suppliers online and purchase material through online auctions. Finally, the third set of technologies focuses on collaboration with customers or suppliers, and relates to web-based EDI, forecasting, inventory replenishment, and scheduling capabilities.

### 4.2 Human IT Capability

This construct contains three sub constructs, namely: knowledge and skills, top management support, and strategic planning.

#### 4.2.1 Knowledge and Skills

Tan et al. describe human IT resources as the availability of employees with adequate experience and exposure to information and communications technology (ICT) and other skills (such as marketing, business strategy) that are needed to adequately staff Ecommerce initiatives and projects (Tan et al., 2007). Power says of the importance of knowledge and skills of employees, "staff would need to be trained in the use and potential of the technology in order to be able to effectively apply them within their environment, and in order to relate effectively with trading partners"(Power, 2004).

#### 4.2.2 Top Management Support

enhances IT success by making resources available for implementation, integrating IT with business strategy and processes, and ensuring continuity in IT investment over time (Powell & Dent-Micallef, 1997).

#### 4.2.3 Strategic Planning

It is a critical task especially for IT-enabled SCM. It has long-term implications on the performance of IT in SCM systems (Gunasekaran & Ngai, 2004). According to Powell et al. the importance of selecting strategic opportunities requires real links between management information system and strategic planning. Additionally it requires management ability to seek out, to find, and to recognise these strategic opportunities (Powell & Dent-Micallef, 1997).

### 4.3 Supply Chain Integration Capability

Several authors recognize that integration is a fundamental principle of SCM (Cooper et al., 1997; Gould, 1998; Mabert & Venkataraman, 1998; Tan et al., 1998). Supply chain integration links a firm with its customers, suppliers, and other channel members by integrating their relationships, activities, functions, processes and locations (Kim & Narasimhan, 2002).

Frohlich and Westbrook studied the effect of web-based integration on demand chain management's operational performance. In their study, web-based supply chain integration was measured by two constructs: (1) e-integration with suppliers and (2) e-integration with customers (Frohlich & Westbrook, 2002).

They suggest that as supply chain integration increases as a result of e-business, stronger relational ties develop between the companies across supply chains (Frohlich & Westbrook, 2001).

#### 4.4 Firm Performance

In the conceptual model we propose that supply chain integration capabilities act as a mediating role between IT-related resources and firm performance. Enhancing supply chain integration can impact firm performance in several ways. (Frohlich & Westbrook, 2002) distinguish web-based demand chain integration from supply chain integration.

They report that manufacturing and services firms adopting both demand integration and supply integration had the highest operational performance in delivery time, transaction costs, profitability, and inventory turnover.

Bowersox et al. assert that supply chain integration through its interface with customer relationship management system allows a firm to respond to customer inquiries, track customer orders, and provide better after-sale service. This capability of a firm is directly related to its market performance (Bowersox et al., 1999).

Supply chain capabilities can also potentially improve a firm's financial performance through a cost advantage over competitors. Information sharing in the supply chain may reduce demand uncertainty, and the cost of inventories in the process of matching supply with demand in the supply chain network (Frohlich, 2002).

## 5 MANAGERIAL IMPLICATIONS AND CONCLUSIONS

The traditional way of managing supply chains has changed dramatically over the last decade. We study the business value of information technology and digitalization on supply chain management and supply chain relationships. This paper intend developing a 'best fit' model which can be used by organizations to leverage their SCM capabilities in order to enhance their overall performance and competitive advantage. Essentially using the conceptual model, we intend to empirically validate in the near future, organizations' SCM capabilities, (IT infrastructure and Human IT) in influencing their relationships both with suppliers and customers. This then would benefit them immensely to improve and enhance their financial, market and operational performance. As supply chain networks involve several stakeholders, the efficiencies gained by using 'best practices' would obviously translate into benefits for all concerned.

The ultimate desired managerial implication of successful validation of the proposed model would be to provide to business organizations specific guidelines for the management, change and resource of the various components found to contribute within the proposed conceptual framework to organizational performance. As mentioned, the model could also be extended to take in up and down stream relationships and dynamics.

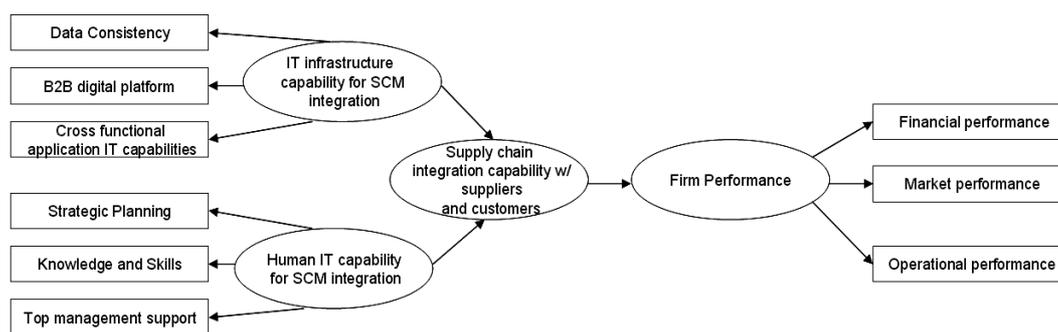


Figure 1: An integrated conceptual framework: IT resources, e-SCM capabilities and Firm Performance.

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