



# Extended Enterprise Resource Planning Systems (EERP) and Supply Chain Integration: A Literature Review

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**Abstract:** The ‘successful’ organization of the future is going to depend upon virtual organizations quickly providing quality customer driven products and services. At the heart and centre of these, will be strategic information systems such as the enterprise resource planning system (ERP), this system when used across the supply chain, its referred to as the Extended Enterprise Resource Planning System (eERP). This strategic system will enable multiple organizations to effectively coordinate their operations in an effort to manage a supply chain by supporting supplier and customer linkages and providing required information across the supply chain quickly for improved performance of all organizations in this agile supply chain. The question here is whether the eERP narrows the integration gap between organizations.

**Keywords:** Extended Enterprise Resource Planning System, Supply Chain Integration.

## 1. Introduction

Today, EERPs form an integral part of most organization’s operations. Firms use EERPs to effectively manage end-to-end logistics and procurement organizational processes. This system is used to handle operations within the firm and across its supply chain; processes such as order management, bill of materials, planning, purchasing, shop floor control, inventory management, demand management, product costing, forecasting, and master production scheduling (Gupta, 2000). ERPs, moreover, have been employed in corporate services to help organizations cope with their cost-intensive corporate functions by primarily supporting and streamlining administrative processes in key areas such as health, corporate travel, safety compliance, global trade services, and environment (Bradford and Florin, 2003).

Effective implementation of EERPs in all the functional areas can yield beneficial outcomes to an organization (Al-Mashari *et al.*, 2003). These may, for instance, take the form of a more efficient and customer driven operations. This is largely because; EERPs tend to bring about a relatively faster response to and follow up with an organization’s customers(Hendricks *et al.*, 2007). By integrating distinct organizational processes in production, sales, logistics, human resource and finance, the entire organization can most effectively respond to customer or supplier requests.

## 2. Strategic use of Information Systems

Developments in Information Communication Technology (ICT) and Information Systems (IS) coupled with competition have led organizations to think of ways in which they can strategically use technology to gain competitive advantage. In today’s organizational context, a number of organizations have incorporated Information Systems (IS) in their strategic plans. (Chen *et al.*, 2010) identifies three key persistent strands within IS strategy. The first strand entails aligning IS with the organizational strategy. The second strand consists of strategic information system planning, which is often geared towards identifying relevant system portfolios. Thirdly, the resultant systems are deployed in the organization strategy to achieve competitive advantage (Chen *et al.*, 2010). This position is supported by other researchers (Chan and Reich, 2007); (Piccoli and Ives, 2005).

With the increasing degree of globalization, competition is inevitable. The use of IS for competitive advantage is grounded in Michael Porter’s generic strategies, which details the manner with which a business organization can achieve a competitive advantage in the industry by focusing largely on its value

chain. A value chain consists of a series of activities, which create and build value culminating in total value delivered by the business. The key generic strategies, in this context, include cost leadership, differentiation, innovation, growth and strategic alliance, which have been cited in a number of studies (Chui and Fleming, 2011); (Booth *et al.*, 2011); (Manyika, 2009).

According to Booth *et al.* (2011), businesses can strategically use IS to achieve cost leadership by essentially shifting or reducing their cost of doing business with its customers and suppliers. For instance, organizations can use e-procurement systems to trim down the operation costs of transacting with their suppliers. Differentiation is a vital aspect of achieving competitive advantage in business. Manyika (2009) Demonstrates that business organizations can use IS to develop unique products that tend to differ significantly from those of their rivals. This could be done, for instance, through the creation of intermediaries that offers value-added products and services.

Businesses can utilize IS to expand the scope of their domestic and international operations (Chui and Fleming, 2011). Equally, organizations can adopt IS to diversify and integrate into products and services that are not within the scope of their operations; that is, establishing an omni-channel strategy to gain growth. Innovation is an important aspect of competitive businesses. Manyika (2009), assert that organizations can use IS to identify new markets and develop new products and services, and equally, radically alter their business processes through automation. Chui and Fleming (2011) add that businesses may use simulation and digital modeling of product design to trim down the cost and time of delivering them to the market.

Apart from the basic generic strategies, organizations can adopt other competitive strategies that are facilitated by IS, which have been cited in O'Brien and Marakas (2011) and Chui and Fleming (2011). They include using IS to lock in suppliers and customers by solidifying existing relations and building new valuable relationships through partner/customer relationship management systems. Organizations may, moreover, opt to increase the switching cost of its customers and suppliers through the creation of certain applications. A typical example can be attributed to building costs that have been created through proprietary software applications and extranets such as Amazon's useful and user-friendly B2B website (O'Brien and Marakas, 2011). Such applications have evidently made it difficult for the company's suppliers and customers to switch to other companies for fear of incurring significant costs, which may take the form of money, time, effort and inconvenience.

Manyika (2009) argues that an IS can be utilized to prevent the entry of new firms or substitute products or services into a specific industry or line of business by primarily increasing their barriers to entry through flattening or optimizing organizational structure by essentially increasing the complexity or amount of technology required to enter into a specific market or industry.

Most researchers, Piccoli and Ives (2005) and Chen *et al.* (2010) have agreed that regardless of the strand under examination, the success of any IS strategy depends significantly on the manner with which it is enacted. Thus, successful IS strategy requires firms to maintain a tight link between their strategic intent, the implementation of IS strategy and the de facto realized strategy (Chen *et al.*, 2010). This evidence apparently points out the three critical challenges to successful implementation of an IS strategy. This entails achieving a theoretical alignment between system capabilities and strategic intent; implementing the IS organizationally, and shaping the use of the system and similar practices to attain practical configuration with the strategic intent. The use of enterprise wide systems have been found to bridge the link between IS and business strategy, most popular is the ERP and EERP systems.

### **3. ERP and EERP Systems**

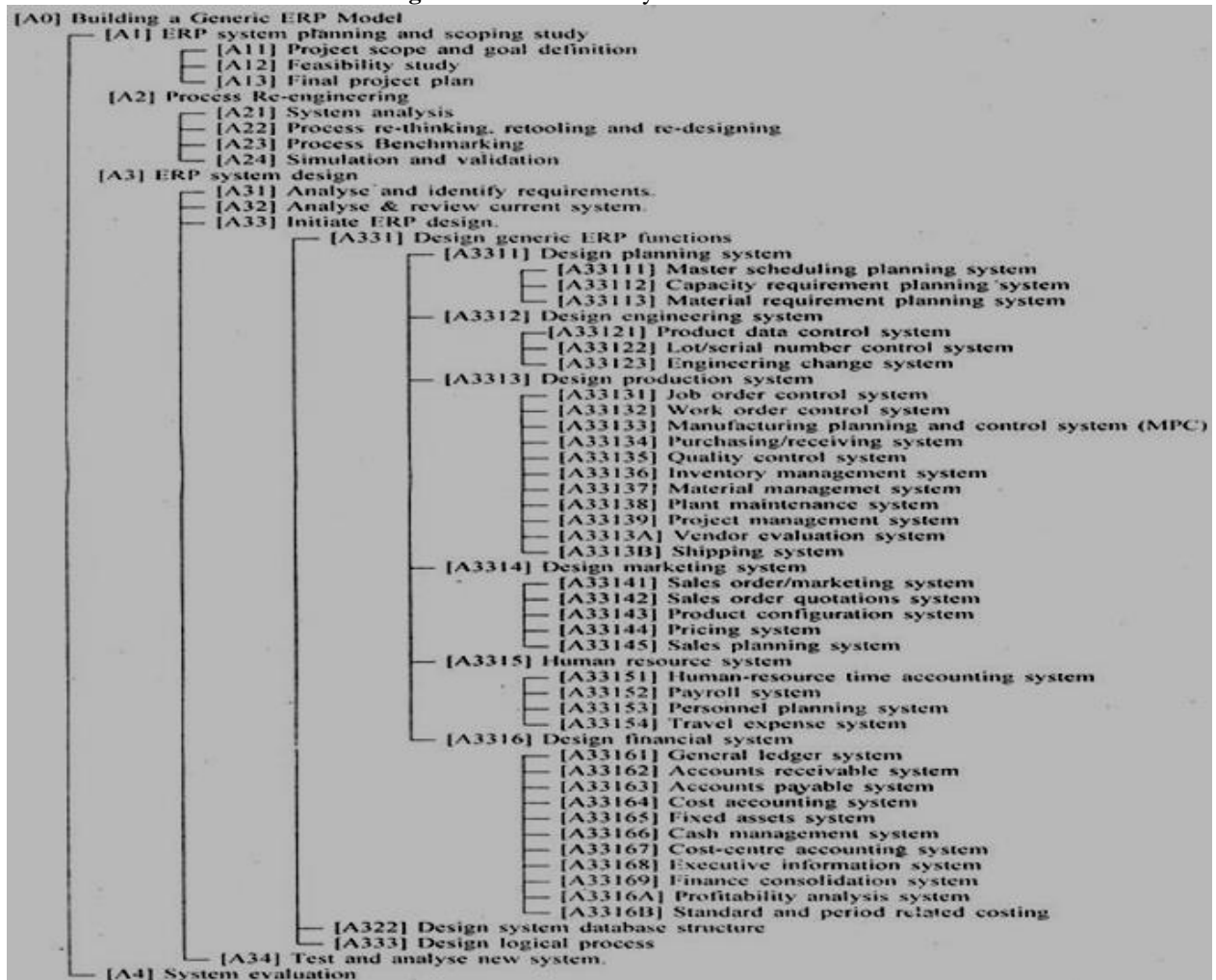
Enterprise software's consist of a set of interdependent program modules, which support internal organizational processes such as human resources, finance and accounting, sales and marketing, and production and manufacturing (including logistics and distribution). The system allows data or information to be used by multiple business processes and functions for precise organization control and coordination (Stratman and Roth, 2002). The ERP is, ideally, built around a number of predefined business processes. On the other hand, the Extended ERP supports all these internal functions but also has Supply Chain Management Modules and Customer Relationship Management Modules to support external functions such as interactions with suppliers and interactions with customers.

Huang *et al.* (2007) acknowledge that the task of designing an integrated ERP model is complex and entails mapping of the functions, decision process, material flow and information flow that oversee the dynamic process of the organization. Therefore, the ERP System is considered as a game plan for planning and monitoring all the organization's resources, including functions such as marketing, finance, manufacturing and engineering. Owing to its applicability, ERPs have been recognized as being an

equivalent of an effective management system, which has a sound planning and scheduling providing significant benefits in productivity, higher inventory returns, significant reduction in material costs, and dramatic increases in customer service (Mabert *et al.*, 2001).

A typical general model of ERPs comprises of two building blocks: hierarchical model and object oriented model (Murphy and Simon, 2002). Thus, from a general perspective, a ERPs design consists of a development tree structure, which presents different functional nodes of the parent system as depicted in figure 1.

Figure 1. General ERP system architecture/model



Source: Parr and Shanks (2000)

### 3.1. ERP and EERP Implementation and Usage

ERP systems have a number of applications in business. Such systems have been cited, in some sources such as in Al-Mashari and Al-Mudimigh (2003), as providing role based access to vital business data, analytical tools and applications in a number of organizational areas. First, evidence reveals that financials use ERPs to ensure compliance and certainty of business performance. This implies that an organizations can utilize such systems in the attempt to gain an in depth financial insight and tighten the control of its financial resources through the firm. This can be achieved through the automation of financial supply chain management, management accounting and financial accounting.

ERPs have equally been widely applied in the management of human capital. Today, evidence reveals that most organizations employ ERPs in the optimization of human resource processes with an inclusive, integrated and international human capital management solution (Davenport and Brooks, 2005). This is achievable through the automation of core Human Resource processes, talent management, and workforce deployment, which results to increase employee efficiency and increased compliance with the changing local and global regulations.

Today, ERPs form an integral part of most organization's operations. Firms use ERPs to effectively manage end-to-end logistics and procurement organizational processes such as order management, bill of

materials, planning, purchasing, shop floor control, inventory management, demand management, product costing, forecasting, and master production scheduling (Gupta, 2000). ERPs, moreover, have been employed in corporate services to help organizations cope with their cost-intensive corporate functions by primarily supporting and streamlining administrative processes in key areas such as health, corporate travel, safety compliance, global trade services, and environment (Bradford and Florin, 2003).

Al-Mashari *et al.* (2003) Agree that, in all the functional areas, effective implementation of ERPs can yield beneficial outcomes to an organization. These may, for instance, take the form of a more efficient and customer driven operations. This is largely because; ERPs tend to bring about a relatively faster response to and follow up with an organization's customers. By integrating distinct organizational processes in production, sales, logistics, human resource and finance, the entire organization can most effectively respond to customer or supplier requests (Hendricks *et al.*, 2007).

The key goal of ERPs is to unit various business units or departments across an organization through an application package of one system whereas the EERP units different organization to one virtual organization. The information, which is managed by both the ERP and EERP system, may be used in various ways. For instance, executives and employees in customer service, production, finance and accounting are able to depend on the information delivered from the system from across the supply chain in making more effective decisions. This implies that an EERP system provides organizations departments and its supply chain partners with the ability to share information, which gives them the capacity to work harmoniously and communicate across a universal interface. According to Murphy and Simon (2002), ERP system facilitates the integrated flow of information to all the essential components of the organization. And the EERP system facilitates information flow across inter-organization boundaries. This, in turn, enables various components to work together towards the attainment of excellent organizational and supply chain performance.

#### **4. Supply Chain Arcs of Integration**

At the tactical level, Frohlich and Westbrook (2001) identify two key interrelated forms of supply chain integration, which organizations regularly employ. The first form of integration entails coordinating and integrating the forward flow (physical) of deliveries (goods and services) from suppliers to organizations and customers. Most of the proponents of supply chain integration support the Just-In-Time strategy (Armistead and Mapes, 1993). Others, however, have pointed out the significance delivery integration that comprises of the implementation of mass customization and product postponement in the supply chain (Adaileh and Abu-alganam, 2010).

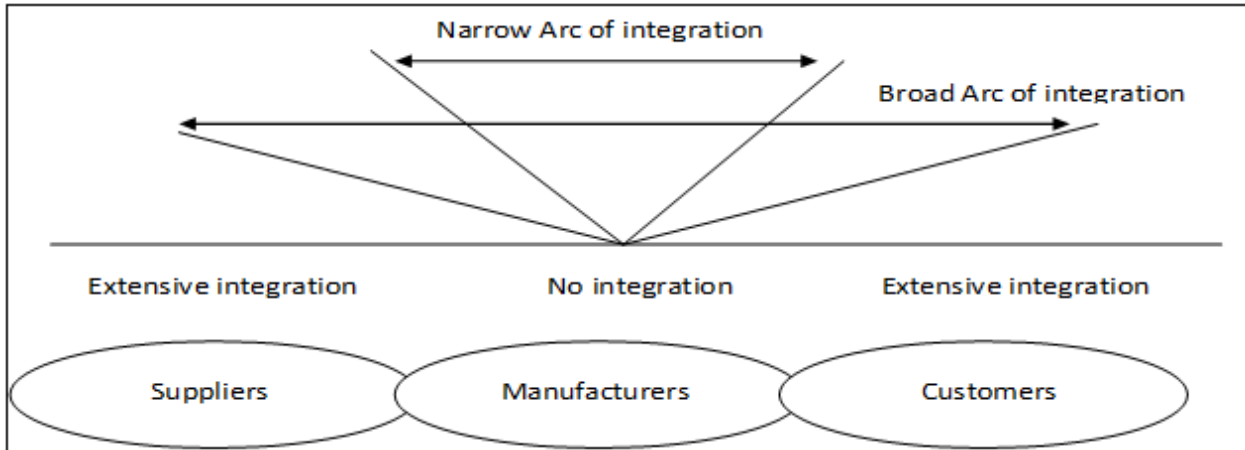
The second key form of integration includes backward coordination of the flow of data and information technologies from customers to suppliers. Sources have shown that IT permits multiple organizations coordinate their operations in an effort to effectively manage a supply chain. The integration using information technologies primarily comprises of Electronic Data Interchange as well as traditional control and planning systems. More recently, the EERP system is used in integration of the supply chain.

If the need to develop shared operational activities within an organization is accepted, then the issues of strategic nature tend to become one of degree and direction. All firms implicitly tend to make strategic decisions regarding the extent of downstream and upstream integration, which they want to undertake (Lambert and Cooper, 2000). Some may decide to engage in a moderately little integration with customers or suppliers. In this context, they are said to have a narrow arc of integration. On the other hand, some firms may extensively integrate their operations with downstream customers and upstream suppliers by pursuing a strategy, which is described as a broad arc of integration (refer to figure 2.3).

Evidence suggests that a broad arc of integration with customers and suppliers in the supply chain is associated with higher potential benefits (Frohlich and Westbrook, 2001). When firms act and integrate as a single entity, sources agree that performance is often enhanced throughout the chain. There is need for firms to not only manage their own operations but also participate in the management of the network of downstream and upstream firms. Firms traditionally structured as independent businesses are required to increasingly configure their operations on a shared basis hence the need for shared systems such as eERP. By extension, firms coupled with the broadest arc of integration should be characterized with the highest levels of improvements in performance (Frohlich and Westbrook, 2001).



Figure 2. Arcs of integration



Source: Frohlich and Westbrook (2001)

## 5. Theoretical Foundation

This section presents two underlying theories that are used in this research. These are the Virtual Integration Theory, Social Systems theory and the Stakeholder theory. The Virtual Integration theory is the most relevant in this study. In the current competitive business environment, individual organisations are not able to deal with the threats from the external environment on their own hence the need to involve its supply chain partners. Supply chain integration creates an agile supply chain by obtaining timely feedback and collaborating to improve product and customer service. Virtual integration in this case captures the extent to which supply chain partners seek to use IT in vertical coordination and control of their activities in the supply chain

The socio-technical systems theory looks at the firm as a heterogeneous network comprising of a social subsystem and a technical sub-system [Avgerou \(2001\)](#). The theory recognizes the interaction between technology and people in the work place. In this sense, the substructures within the society and the society itself form a complex socio-technical system. How well the two systems interact, the technical and the social system will lead to success or failure in the use of the Extended Enterprise Resource Planning System. Ideally, the socio-technical system theory focuses on the aspects of people and society as well as the technical aspects of organizational processes and structure. The term ‘technical’ in this context does not necessarily mean material technology but rather the procedures involved. This theory is vital in explaining the integration of ERP system with supply chain networks since the theory attempts to integrate aspects of technology and those of the society [Van et al. \(2013\)](#).

The stakeholder theory is equally vital in this context since it focuses on organizational management and business ethics, which addresses values and morals in managing an organization. The stakeholder theory argues that the actions of various stakeholders are primarily driven by the intrinsic benefits that will accrue to them [\(Donaldson and Preston, 1995\)](#). In short, the stakeholder theory attempts to address the principle of what or who really counts. From a general perspective, the stakeholder theory argues the need to balance the interests of all stakeholders within an organization, which include customers, suppliers, shareholders, and employees, among others [\(Miles, 2012\)](#). An examination of the stakeholder theory is vital since it is concerned with fulfilling the interests of some of the key players within the supply chain of an organization; the organisation itself, its customers and its suppliers [\(Friedman and Miles, 2002\)](#).

## 6. The Conceptual Framework

The Independent variable is eERP implementation Success. This will be achieved if the system is implemented within the specified time and budget constraints. User attitudes and acceptance of the system is also very important in successful usage of the system. And the system must align to the Supply Chain Objectives to be used by all the stakeholders.

The dependent variable is Supply Chain Integration. A supply chain can have a narrow arc of integration or a broad arc of integration. A narrow arc of integration occurs when a business firm does not coordinate with its suppliers and customers. Whereas a broad arc of integration occurs when a business firm integrates and coordinates forward flow of deliveries of goods and services from suppliers to

customers and a backward flow of data and information technologies from customers to suppliers. This study proposes a broad arc of integration for smooth coordination of the supply chain activities.

Figure 3. EERP system Implementation Model



Source: Author (2016).

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