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INTEGRATING BUSINESS-TO-BUSINESS CUSTOMERS IN ORIGINAL EQUIPMENT MANUFACTURERS' SUPPLY CHAINS THROUGH INFORMATION SYSTEMS INTEGRATION

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Abstract

Original equipment manufacturers (OEMs) are increasingly being urged to integrate their business-to-business customers into their supply chain. This involves integrating the information systems of the OEM's supply chain with those of the customers. However, the literature has little to say about what it takes to integrate the information systems of OEMs' supply chain and business customers. This paper develops a framework that identifies different levels of integration of business customers' information systems with those of the OEM's supply chain. It then discusses how this integration affects market performance and strategic gains that accrue to the chain. However, if such systems are integrated without appropriate conditions within and outside the OEM's supply chain, it may not be possible to actualise the potential of such integration. Therefore, we also identify and examine how a variety of contextual factors moderate the effectiveness of customers' systems integration in a supply chain.

Key words: Customer Orientation; Business-to-Business Relationships; Supply Chain Integration; Business Customer Information Systems; Information Systems Integration.

Introduction

As the Internet is increasingly being embraced by Business-to-Business (B-to-B) marketers, a new way of doing business is emerging in the traditional B-to-B world. This emerging change gives rise to several strategic implications for how B-to-B marketers or original equipment manufacturers (OEMs) should deal with customers. However, little effort has gone into examining this new world of B-to-B, and how and when it leads to improved performance for the OEM and their business customers.

The increased use of the Internet has led to a strong trend toward the development of integrated supply chains in the B-to-B arena in which information and communication systems of various supply chain partners are integrated over a Web interface. Such Web-based supply chain systems or e-supply chain systems have helped chain partners collaborate with one another and, among other things, make their supply chains more responsive to changes in demand and supply.

However, so far Web-based supply chain systems have focussed more on integrating upstream suppliers with an OEM's supply chain, and much less attention has been paid to integrating downstream business customers (Fisher 1997; Hutt and Speh 2001; Margretta 1998; Subramani 2004). Later, we highlight the major differences between customer-oriented and supplier-oriented supply chain systems. Downstream business customers can range from manufacturers that take the products, parts, or subassemblies supplied by the chain, and use them in their final products (e.g., Canon sells its ink cartridges to other small printer and photocopier manufacturers) to firms that resell the product as it is, without modification (e.g., Canon sells complete printers through retailers such as BestBuy). Even though experts are increasingly urging that customers be integrated into the supply chain for improved responsiveness (Campbel and Sankaran 2005; Rosenzweig et al. 2003; Zhao et al. 2013; Zhao et al. 2011), in a large number of cases, the integration effort is usually limited to using information technology for making customer point-of-sale data visible to chain partners, implementing a customer relationship management (CRM) system, customisation and personalisation of data, or mining the customer data for some patterns and relationships (Chen and Ching 2004; Hormozi and Giles 2004; Albert et al. 2004; Chan 2005; Zahay and Griffin 2004; Ray, Muhana, and Barney 2005; Liang and Tanniru, 2006). While in the case of many business-to-customer (B-to-C) situations, only this level of customer integration may be possible (and is likely to be sufficient), much more integration is needed and can be achieved between B-to-B customers and the supply chain (Lau et al. 2003; Esper et al. 2010). An exploratory study exists by Lichtenthal and Eliaz (2001) of B-to-B exchanges, which concluded that these exchanges would need to tie product demand to supply chains and fulfillment (Konicki 2000), but the study's purpose was not to examine how to effectively and comprehensively integrate B-to-B customers.

Integration of B-to-B customers into OEMs' supply chain is quite challenging, and yet it offers an opportunity for substantial improvement by establishing digital linkages. The amount of business

data and information that are exchanged between such businesses is becoming too large to be quickly processed or integrated manually. At the same time, business data and information are increasingly being transported over universal networks such as the Internet, which offers a great opportunity to develop digital linkages. Integration of customers' information systems in an OEM's supply chain essentially comes down to the integration of the information systems of these two parties (Zhu et al 2002; Plakoyiannaki and Tzokas 2002; Chan 2005). However, the integration of business customers' information systems in the OEM's supply chain information systems is an under-researched area. As such, this study focusses on integration of business customers' information systems with the OEM's supply chain systems.

There are many benefits from integrating supply chain and customers' information systems. As exchange of data and information between business customers and the supply chain is digitised, and as information across the chain is made visible, much inefficiency of paper-based transactions is removed (Premkumar et al. 1994; Premkumar and Ramamurthy 1995). The supply chain benefits, as business customers' information systems can now quickly and accurately provide timely demand data to the supply chain (Asgekar 2004). The above factors can result in a chain-wide reduction in waste and inventory. Additionally, business customers can be expeditiously intimated about exceptional situations such as production and logistics disruptions that might occur upstream, allowing them to take quick corrective or remedial actions (Pant et al 2003). Furthermore, business customers can be integrated into the new product development process with the OEM and its supply chain, thereby leading to customised and timely product and service offerings for business customers (Sethi et al. 2003). These initiatives in many cases are likely to lead to a stronger relationship between the chain and its business customers.

Considering the above potential benefits of integrating business customers' systems into a supply chain, high levels of systems integration may seem universally desirable. However, high levels of integration of business customers' systems entails costs - not only the costs of technology, but also those of integrating complicated systems, redesigning intra- and inter-organisational processes, disrupting the status quo, and spending management time and energy during implementation. Therefore, it may not be wise for OEMs to opt for high levels of integration of business customers' systems into their supply chain systems without the following analysis.

From an OEM's or supply chain's perspective, it is only worthwhile to opt for high levels of customers' systems integration only under conditions where inexpensive low-level systems integration does not deliver the desired value. Furthermore, if business customers' systems are integrated with the OEM's supply chain systems without the presence of appropriate conditions within and outside the OEM's supply chain, then it may not be possible to exploit the full potential of such integration. However, little is known about the conditions that can help actualise the potential of business customers' systems integration with the supply chain. Therefore, this paper develops a framework that focusses on how integration of business customers' information systems with an OEM's supply chain systems influences the outcomes of such integration (i.e., performance

and strategic gains), and how this relationship between business customers' systems integration and its outcomes is affected by various conditions or contextual factors.

For the development of the above framework, we draw on three main theories of inter-organisational relationships, namely: Transaction Cost Economics; Resource-Based View, and; Knowledge-Based View (Williamson 2005; Wernerfelt 1984; Grant 1997; Hult et al. 2004), as well as rich research in areas such as B-to-B marketing, organisational theory, new product development, inter-organisational information systems, Enterprise Resource Planning (ERP), and CRM systems.

Although some customers can be persuaded by the benefits of integrating their information systems with those of the OEMs' supply chain systems, others will not easily embrace such integration, and may suspect the OEM's intentions and may be fearful of losing confidential business information and control over their business operations. The framework here captures this disposition of customers (or its lack) as a customer-related factor/moderator that can influence tight linkages between customers' information systems and OEM's supply chain systems. An example of such a factor is customers' identification with the OEM's supply chain.

The contribution of this paper lies in offering a theory and research-based conceptualisation of integration of B-to-B customers' information systems with supply chain's systems, and elaborates this concept with the help of three levels of customers' information systems integration. It examines the strategic implications of such information systems-mediated relationships in the B-to-B arena. The paper also shows how the integration of customers' information systems helps supply chains improve their performance and gain strategic advantage in the marketplace. Importantly, the paper highlights the conditions that need to exist for a supply chain to exploit the full benefits of integrating customers' systems with supply chain systems. Many of the contextual factors that we have identified here are new to the Marketing and IT literature.

We begin by discussing theories that have been used to explain systems integration and its effects on outcomes. Then we discuss what is meant by business customers' systems integration in supply chains and next explore the different levels at which customer information systems can be integrated with supply chain information systems. Thereafter we present a conceptual model that discusses how various factors moderate the effect of business customers' systems integration on supply chain performance and develop research propositions. We close the paper with implications for theory and practice.

Theories of Information Systems Integration

In order to explain the effect of systems integration on outcomes, different theories of information systems integration have been used. These theories are transaction cost economics, resource-based view, and knowledge-based view of firms. Transaction-cost economics (Williamson 2005)

focusses on three different costs. Search and information costs (which are incurred in determining that the required good is available in the market); bargaining costs (which are incurred when parties come to an acceptable agreement and draw up a contract); policing**,** and enforcement costs (which are incurred to ensure that the parties stick to the terms of a contract). With information systems integration, there is a reduction in all three costs (Clemons et al. 1993; Patnayakuni et al. 2006).

Theories of information systems integration reveal various benefits that business partners receive from integrating their systems and positive impacts such integration has on the relationship between channel members (Kumar and van Dissel 1996; O'Callaghan, et al., 1992; Bakos, 1987; Cash and Konsynski, 1985; Johnston and Vitale, 1988; Malone et al., 1987). For example, reducing supply chain uncertainty and transaction costs (Konsynski 1993; Kumar and Crook 1999), increasing resource utilisation (Clemons et al. 1992), and introducing products and services in new markets (Kumar and van Dissel 1996). The studies supporting these benefits point toward viewing integrated information systems as vehicles of coordination and communication between business partners that increase the overall performance of a supply chain (Premkumar 2000). Furthermore, as supply chain members become more familiar with one another, they develop more trust (Gulati 1995; Gulati and Singh 1998; Clemons et al. 1993; Patnayakuni et al. 2006). As trust in one another grows and as information flows between supply chain members increase, the possibility of opportunistic behaviours between members decreases (Clemons et al. 1993; Patnayakuni et al. 2006).

There is an equally compelling body of literature – the resource-based view that underscores still another dimension of gains from information systems integration. This view of firms argues that firms possess resources, which enable them to achieve superior long-term performance (Barney 1991; Wernerfelt 1984). Resources that are valuable and rare can lead to the creation of competitive advantage (Barney 1991; Wernerfelt 1984). This advantage can be sustained over longer time periods, to the extent that the firm is able to protect against resource imitation, transfer, or substitution. This theory explains the necessity for supply chain members to work closely with one another. A related theory, Resource Dependency Theory, proposes that actors lacking in essential resources will seek to establish relationships with, and be dependent upon others in order to obtain needed resources. Within this perspective, organisations are viewed as coalitions that alter their structure and patterns of behaviour to acquire and maintain needed external resources (Pfeffer and Salancik 2003; Hillman et al. 2009). Subramani (2004) has shown the complementarity of the transaction cost and resource-based views in explaining the role of supply chain wide assets in enhancing OEM competitiveness. In a recent exploratory study, Priem and Swink (2012) argue that the resource-based view of the firms is an appropriate lens for studying how supply chain management (SCM) can be a source of competitive advantage for firms.

The third body of literature that deals with gains arising from information systems integration comes from the knowledge-based view of firms (Grant 1997). The knowledge-based theory of the firm considers knowledge as being the most strategically significant resource of the firm. Since

knowledge-based resources are usually socially complex and difficult to imitate, knowledge capabilities among firms are the major determinants of sustained competitive advantage and superior corporate performance. Some researchers have used the absorptive capacity lens to posit that supply chain relationships – by acquiring, assimilating, and exploiting knowledge - can be leveraged to build organisational capabilities (Malhotra et al 2005).

The knowledge of the firm is embedded in, and carried through multiple entities, including organisational culture and identity, policies, routines, documents, systems, and employees (Grant 1997; Eisenhardt and Santos 2002; Dhillon, 2008; Fabian and Dhillon, 2007). Originating from the resource-based view, this knowledge-based perspective of firms has its roots in strategic management literature and is thought to be building upon and extending the resource-based view of the firm that was discussed earlier**.** Knowledge creation and utilisation in firms is thought to give them capabilities to deal with emergent and changing market conditions that in turn leads to competitive advantage (Zahra and George 2000). In a related manner, Dyer and Singh (1998) suggest that a firm's critical resources may span firm boundaries and may be embedded in inter-firm resources and routines. Increasingly, firms are gaining competitive advantage from resources that are embedded in inter-firm relationships. It is also suggested that information technologies can play an important role in the knowledge-based view of the firm in that information systems can be used to synthesise, enhance, and expedite large-scale intra- and inter-firm knowledge management (Alavi and Leidner 2001). Thus the view that firms gain competitive advantage through the sharing of supply chain-wide resources and relationships helps in the study of systems integration and its effects on outcomes. Next we discuss the different levels at which business customers' information systems integration in supply chains can take place.

Levels of Business Customers' Information Systems Integration in Supply Chain

It has been suggested in a different context that the integration of information technologies in the value chain can take place at different levels, - e.g., automation of discrete transactions, cross-activity integration, and integration of the entire value chain (Porter 2001). Likewise, we argue that an organisation desiring to integrate its business customers' information systems in its supply chain can do so at varying levels of functionality and sophistication. This can range from basic data exchange systems that automate routine tasks, such as on-line purchasing and order tracking, to the highest level of sophistication, where customers' systems are seamlessly integrated with the rest of the supply chain. We elaborate on the concept of customers' information systems integration in supply chains by discussing three distinct levels of integration, namely: (1) transactional data integration with the OEM in the chain; (2) process and application integration with the OEM, and; (3) process and application integration across the supply chain. We also illustrate how these three levels differ from each other in terms of three critical supply chain activities, viz., matching of demand and supply; handling of exceptions at both the supply and demand end, and; development or customization of new products (Davenport and Brooks 2004;

Sethi et al. 2003). It is important to note that each successive level of sophistication consists of all the features and capabilities of the previous level, and more.

Transactional Data Integration with the OEM

At this level, mainly routine transactional data between the customer and the OEM is integrated. OEM's and customer's information systems largely operate independent of each other. There is a low degree of process dependency and integration between the two systems. Therefore, there is little need to develop a homogeneous, integrated, cross-enterprise infrastructure. Furthermore, communication between the two systems is asynchronous and the data between the systems is not updated in real-time (Pant, et al. 2003; Premkumar and Ramamurthy 1995; Grover 1993; Angeles 2000).

As an illustration of this level of integration, let us say a business customer uses its own systems to carry out demand planning and to generate its order, and places the order on-line with the OEM. The order is processed at the OEM's end, order confirmation and tracking details are communicated to the customer via e-mail or an interactive Web page, and the customer manually incorporates that data into its own system. This level of integration is mostly good for routine customer-oriented tasks like buying on-line and tracking orders. Such integration of transactional data can be implemented at a low cost as most organisations have some amount of IT and access to the Internet. This level of integration can also be achieved via B-to-B exchanges, also known as Electronic Hubs (Ravichandran et al. 2007).

However, a limitation of this functionality is that it merely automates routine transactions between the business customers and the OEM**,** but the two systems do not automatically update data in one another. This prevents dynamic matching of demand and supply at the OEM's end, as well as in the supply chain. This low level of integration also prevents immediate, real-time intimation of exceptional situations, such as production and transportation delays to business customers, and thus it slows down corrective action. Nor can exceptional demand from customers' side be conveyed in near real-time to the OEM or the supply chain, and as a result supply chain responsiveness suffers.

Furthermore, joint new product development efforts between the OEM and the business customer, as well as the attempts to customise the product for different needs of the customer remain limited, due to a lack of real-time and in-depth integration between their two systems. Thus, as the theory suggests, benefits derived at this level of integration are merely transactional and do not help firms in strengthening their competitive resources or in enhancing the knowledge of a firm.

To some extent**,** the limitations of this level of integration are taken care of by the next level of business customer integration.

Process and Application Integration with the OEM

At this level of integration, the OEM and business customers' systems are integrated at the data, process, and application levels. This level is characterised by integration of business processes between the OEM and its business customers (Irani 2002; Themistocleous 2004; Lee et al. 2003; Kleeberg et al. 2014). It also requires the development of an integrated and compatible infrastructure between the OEM and its business customers that enables continuous and real-time communication (Pant, et al. 2003). Such a platform serves as a valuable resource for the two firms. For example, a business customer generates a purchase order using their own internal system, which is electronically transmitted to the OEM. This purchase order in turn becomes a sales order at the OEM's end and the order fulfillment process starts.

With this level of integration in place, the OEM and its business customers are able to work together much more collaboratively than before. The OEM has direct and instantaneous access to the demand data in its business customers' systems. Likewise, business customers have direct and instantaneous access to the supply data in the OEM's systems. Therefore, the systems of the two parties can sense and dynamically match demand and supply, which leads to better responsiveness and lower inventories.

Similarly, due to tight linkages between the information systems, exceptional situations such as production and transportation delays are automatically updated in the customer's systems and its decision-makers are alerted. In addition, the two firms can now implement triggers in their systems that can alert both the parties of certain situations, such as low inventory levels, or exceptions, such as delays and disruptions in meeting customer demand (Ireland and Bruce 2000). In some cases, software known as 'intelligent agents' help companies in optimising their inventory and demand planning and vastly improve customer service by minimising human intervention, and thereby reducing errors (Davenport and Brooks 2004; Iyer et al. 2005; Singh et al. 2005; Mattia 2012; Hilletofth and Lättilä 2012).

Due to tight integration between their systems, business customers can participate in the OEM's new product design process. In the case of complex products, customers' direct participation can help the product development experts design products that are more responsive to the needs of its customers and the customers' end customers (Gandhi et al 2014). In some cases, such integration can also enable business customers to virtually design and test a new product, either directly, or through simulation of the product properties. For example, the design chain of the B-to-B electronic component supplier, Avnet (formerly Marshall Industries) allows a business customer to virtually design a chip that is later produced and embedded in a product provided to the customer by Avnet (El Sawy et al. 1999).

However, this level of integration ends at the OEM's internal systems, as the business customers' systems are not directly integrated with the OEM's suppliers and other business partners. This

result in delays in meeting customer demand, hinders joint participation in new product development by other supply chain partners, and reduces the responsiveness of the supply chain to exceptional situations. These limitations are taken care of during the next level of integration, which spans the entire supply chain.

Example of Process and Application Integration with the OEM

We illustrate the process and application integration of customers' information systems with the OEM with a case of an electronic products manufacturer that implemented such an integrated system (Pant et al. 2003).

The purpose of integration in the case of the electronic products manufacturer was to match demand and supply and handle exceptions. In the event of a sudden surge in demand from a business customer, the integrated system checks the OEM's inventory. Since the order is large, and cannot be met by existing inventories, the system lines up the supply chain to boost production to meet the demand. Toward that end, the system alters the production plans of the OEM. This is done via a model that contains information, such as production constraints and lead times for the OEM (Pant et al. 2003). As soon as a feasible production schedule is finalised, the system then automatically updates the customer's system with information about commitments, such as the order quantity to be supplied and firm delivery dates.

Furthermore, as business customers' information systems are directly integrated with the electronics manufacturer's systems, exceptions such as disruptions and delays are communicated downstream, customer's information systems are updated in response to these exceptions, and their decision makers are alerted. When there was a severe earthquake in Taiwan which disrupted the operations of the electronics manufacturer, the integrated systems of the manufacturer made adjustments, and kept customers updated about new delivery schedules. Thus, it can be seen that the capability of a system such as this one to dynamically match customer demand with OEM's supplies as well as to provide exceptional customer service is much higher than in the previous case, where integration levels are low.

Process and Application Integration across the Supply Chain

This level of integration requires that business customers' information systems are not only integrated with the OEM's systems, but also with those of the key suppliers and other business partners. That is to say, data, information, and knowledge from the business customers' systems flows directly into the supply chain and in near real-time, without the OEM consolidating the customer information and transmitting it to key suppliers and other important business partners. In other words, at this level of integration, the entire supply chain, from the customer up to the OEM and its suppliers, works more like a gigantic Enterprise Resource Planning (ERP) system

(Brock 2001; Lee et al. 2003). This results in a much better matching of demand and supply throughout the supply chain, as it enables them to deal with exceptional situations.

Likewise, under the chain-wide integration scenario, business customers can also customise their products, not only by looking at the parts options available at the OEM, but also the options available with the suppliers. Besides enabling matching of demand and supply, this level of integration also makes it possible to provide high levels of customer service. However, this level of integration requires a much higher investment in information and integration technologies all across the supply chain, and demands a much higher commitment from all the chain partners.

An Example of Business Customers' Systems Integration in the Supply Chain

We illustrate the integration of customers' information systems in the supply chain with an example from Boeing Corporation. This illustration shows how strong systems integration between all partners in a supply chain can help in effective and efficient development of new products and can be a source of competitive advantage.

Boeing faced stiff competition from Airbus, which captured a lot of attention through its 550-seat aircraft called A380 that was commercially launched in 2007. Boeing responded to the challenge with its 7E7 Dreamliner (finally called 787), a fuel-efficient aircraft that can fly on longer routes. Boeing decided to design this new aircraft by directly integrating customers as well as its suppliers (Team 2014). In effect, Boeing's suppliers carried out 70% of the design of the 7E7. Boeing and its suppliers jointly developed 3-D models of the aircraft and its parts on their systems, and collaboratively shared them with airline customers to get their input on the design as it evolved. Such intensive use of computer technologies and forward (with customers) and backward (with suppliers) integration slashed the development time for the 7E7 by 18 months over other aircrafts (Waurzyniak 2004; Ferguson 2004; Bacheldor 2004), although the final launch was delayed, due to other reasons (Greising and Johnson 2007).

Thus it can be seen that in the above case, besides gaining transactional efficiencies, the firms also leveraged the joint platform as a valuable resource, and achieved a better product by integrating a variety of information/knowledge that gave them a competitive edge over rival Airbus (Team 2014). Boeing achieved these results by partnering with, among others, the software company Dassault Systems and IBM. Dassault Systems, which was later acquired by IBM, and IBM together provided Boeing with platforms and applications to collaborate closely with its customers and suppliers. For example, Boeing used all the major software packages that we have reviewed in Appendix 1.

These three levels of business customers' information systems integration are summarized in Table 1.

Level of Integration		Supply Chain Activities: Demand-Supply Matching	Exception Handling	Product Development & Customization
Low	**Transactional Data Integration with OEM**	Limited. Asynchronous matching via e-mail, dynamic web pages.	Not efficient; Asynchronous.	Very limited - only some product configuration capabilities
	Process & Application Integration with OEM	Dynamic, real-time matching only with the OEM; Asynchronous beyond that in the supply chain	Efficient between the OEM and business customers; inefficient across the supply chain	Business customers are able to participate in designing and customising products only with the OEM.
High	**Process & Application Integration across Supply Chain**	Dynamic, real-time matching across the supply chain	Efficient across the supply chain	Business customers are able to participate in designing and customising products with the OEM and key suppliers.

Table 1 - Levels of Business Customers' Information Systems Integration

Next we focus our attention on the effect of systems integration on supply chain outcomes.

The Conceptual Model and Propositions

In this section we develop our conceptual model and propositions.

Effect of Business Customers' System Integration on Supply Chain Outcomes

Consistent with our earlier discussion on theories of systems integration and their effect on outcomes, we focus on two types of supply chain outcomes, namely: performance improvement and strategic gains. Performance refers to market performance (such as sales and market share) and profits. Strategic gains refer to increased barriers to entry for competitors and long-term competitive advantage.

As discussed earlier, increased integration of a business customer's systems in the supply chain is likely to lead to better service to the customer in terms of better and timely fulfillment of demand, more effective handling of exceptional situations, and more appropriate and customised new products. Such integration also ensures that information about service parts, technical help, updated product information, patches and upgrades, changes in warranty or product features, modifications in safety requirements, etc., is communicated in an automated and near-instantaneous fashion between the OEM's and customer's information systems. Such steps are expected to lead to better customer satisfaction and to enhance the ability of the business customer to be more responsive to its own end customers. As a result, the likelihood of the customer giving more business to the OEM and its supply chain improves (Brock 2001; Grover 1993).

Furthermore, as the transaction cost perspective suggests (Williamson 2005), when the integration between the customer's systems and supply chain systems increases, it improves efficiency and reduces costs for the business customer. For example, the customer may have reduced inventories because deliveries from the supply chain are more timely and reliable. The inefficiencies of manual communication are minimised and there may be a reduced need for manpower for dealing with the OEM on a day-to-day basis. Increased integration also makes the relationship between the business customer and the OEM more long-term, rather than one that is mainly transactional in nature. As a result, there will be less pressure on the OEM from business customers to constantly reduce prices, which is routinely expected in B-to-B markets. In fact, as the supply chain develops and delivers customised new products that more effectively meet the needs of the business customer and its end customers, the OEM may even be able to get better prices (Nink 2013).

Additionally, increased integration is expected to improve efficiencies, even for the OEM and its suppliers. The supply chain will have reduced inventories and a major reduction in the cost of manual communication and transactions. Such efficiencies coupled with better prices and increased sales are likely to lead to improved profits for the OEM and the supply chain (Pant et al. 2003).

Integration of business customers' information systems with those of the OEM (and the rest of the supply chain) can also bring about strategic gains for the parties involved. When an OEM endeavours to tightly integrate business customers' systems with its own systems, there is a tie-in effect. As suggested by the Resource-Based View (RBV) of firms, once business customers have invested time, effort, and resources in integrating their systems with those of the OEM, they are much more likely to view their relationship with the OEM as a long-term collaborative partnership, and many of them are less likely to switch over to other OEMs for small gains. Furthermore, through tight integration with business customers, the OEM is able to stay close to the end consumers and is able to gauge market demands and shifts in consumer preferences much quicker and more effectively. Such proximity to shifting demands and preferences can be a valuable source of competitive advantage (Zhao et al 2013).

In addition, systems integration can also create digital options both for the business customer and the OEM. The concept of digital options is derived from the real options theory, which focusses on how firms position themselves to seize emergent opportunities. Digital options, therefore, are IT-enabled capabilities that firms can leverage to exploit future opportunities (Sambamurthy et al. 2003). For example, the agribusiness division of the Indian company, ITC trades agricultural commodities such as soybean, coffee, wheat, rice, pulses and shrimp. In 2000, ITC invested in a Web-based initiative called 'e-Chaupal' (Bowonder et al. 2003). The project involved the development of a Web-based system that focussed on providing price information to farmers. This system was also expected to facilitate the buying of agricultural products from farmers. Once such Web-based linkages were established, it opened the door to a very new business opportunity for ITC. The company was able to aggregate demand from farmers and act as an intermediary in the selling of inputs such as fertilizers, seeds, and farm equipment to them. Thus, ITC was able to leverage their investment in Web-based information systems linkages to position itself as a market intermediary for a variety of products that it never traded earlier. This opportunity has not only led to business growth for the company, but has also provided it long-term competitive advantage, as competing firms will take a long time to establish such Web linkages with farmers and to develop close relationships.

An OEM that has accomplished a high level of integration with its business customers is effectively in possession of a valuable and rare asset. As the resource-based view (RBV) (Wernerfelt 1984) indicates, considering the high investment of financial resources, manpower, and time that goes into developing systems integration, it is not easy for competitors to form a close relationship with already-committed customers. Furthermore, bringing about effective systems integration between business customers and supply chains is a complex and time-consuming process that requires uncommon management skills. Competitors cannot easily and quickly imitate or implement such systems integration. Thus, as the RBV suggests, supply chains with tight systems integration with business customers are able to be a more sustainable source of competitive advantage (Barney, 1991). Therefore:

P1: The higher the integration of business customers' information systems in the supply chain, the greater the benefits to business customers and better the performance of the supply chain and its strategic gains.

Factors Moderating the Benefits of Business Customers' Information Systems Integration in Supply Chains

It is important to understand the conditions or contextual factors that make it worthwhile to invest in high integration of customers' information systems in supply chains. By worthwhile, we mean that the benefits outweigh the costs of the system (such as costs of expensive technology, integrating complicated systems, redesigning intra- and inter-organisational processes, disrupting

the status quo, and spending management time and energy during implementation). Therefore, we study how the relationship between customers' information systems integration and net benefits from such systems can be moderated by a number of contextual factors.

In the traditional context of EDI, the Technology-Organisation-Environment (T-O-E) framework is used, which identifies three categories of factors that are expected to play a role in systems integration efforts in a supply chain (Iacovou, et al. 1995; Kuan and Chau 2001). These three categories of factors serve as the starting point for our framework. However, systems integration between customers and supply chain is richer and more multidimensional than simple data-based integration through EDI.

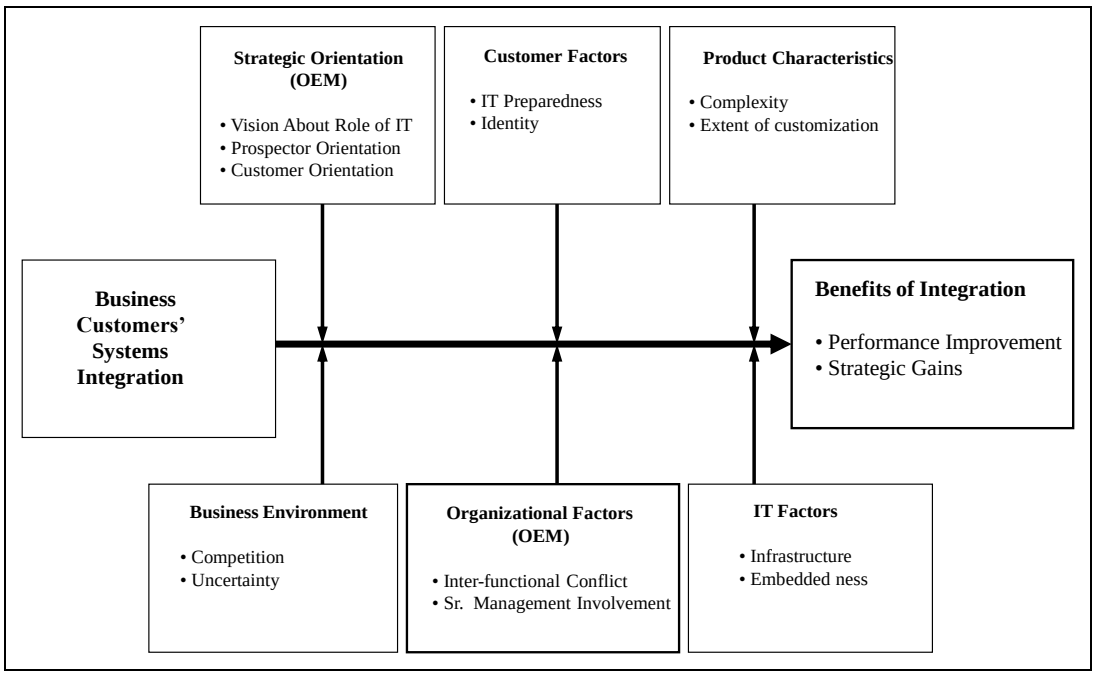

Figure 1 - Business Customers' Information Systems Integration in Supply Chains and its Benefits

Therefore, the range of factors we take into account in our study is greater than that considered in the T-O-E framework. For example, in the Organisation category, in addition to the traditional organisational structural and senior management factors, we also need to include factors related to the strategic orientation of the OEM and the characteristics of its products, because they can influence how much benefit can be extracted from integrated systems. Furthermore, a framework about customers' systems integration also needs to consider factors related to business customers of the supply chain, as they can influence the gains that can be derived from systems integration

efforts. As such, the number of categories of factors that we consider as moderators of the effectiveness of integrating customers' systems is six, namely: OEM's strategic orientation; customer factors; product characteristics; business environment; OEM's organisational factors, and; information technology factors.

Strategic Orientation of the OEM

OEMs may have differing views about the role of IT in the firm's strategy. While some OEMs actively adopt IT and newer developments in the belief that IT can help them enhance their key resources and competitive advantage, others see IT merely as being an enabler of transactional improvements, such as process automation (Grover 1993; Premkumar and Sambamurthy 1995; Sass and Keefe 1998; Saeed et al. 2005; Ravichandran and Lertwongsatien 2005; Kumar 2004). These two vastly different attitudes toward IT can impact the ability of OEMs to derive meaningful gains from their systems integration efforts. Thus, the first strategic variable of interest in our conceptualisation is the OEM's vision about the role of information technology in their strategy. Similarly, an OEM's prospector orientation can play an important role in how much it can leverage integration with its business customers (Miles and Snow 1978) and is a part of our conceptual model.

Yet another strategic factor that deserves attention is the level of the OEM's customer orientation, i.e., how much its strategy and decisions are driven by the needs and desires of its customers. In behavioural terms, customer orientation refers to the organisation-wide collection of customer and market intelligence, dissemination of the intelligence throughout the firm, and responding to market developments based on the intelligence (Kohli and Jaworski 1990). Collection and dissemination of customer or market intelligence can be facilitated through information systems, particularly by integrating the customer's systems with those of the OEM's supply chain. OEM's customer focus can have an important influence on the benefits that will accrue from such integration (Chan 2005). Therefore, we include customer orientation of the OEM along with IT orientation and prospector orientation in our model, and discuss their influence on the effectiveness of business customers' information systems integration.

- *Vision about Role of IT*

Higher levels of business customers' systems integration in supply chains are expected to be more suitable for OEMs that envisage a proactive role for information technology in their business strategy. As RBV and knowledge-based views of firms would suggest, such firms see IT as a source of competitive advantage and they look for technologies that bring quantum gains in productivity or improvement in a variety of supply chain activities and processes (Grover 1993; Premkumar and Sambamurthy 1995; Sass and Keefe 1998; Saeed et al. 2005; Ravichandran and Lertwongsatien 2005; Kumar 2004). Moreover, OEMs with a proactive vision for information technology are generally willing to devote their key resources to install and implement such technologies

successfully, and to constantly maintain and upgrade them (Maier et al 1997). Such OEMs also try their best to motivate and involve their business partners to adopt IS applications, standards, and architectures that facilitate inter-organisational integration and thus improve supply chain performance and strategic gains. In effect, with such a proactive vision for IT, the benefits of high integration of business customer's systems are likely to outweigh their costs. Therefore,

P2: The more proactive the OEM's vision for the role of information technology in its strategy, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Prospector Orientation*

Firms with a prospector orientation aggressively pursue opportunities to keep themselves ahead of others (Miles and Snow 1978). They are more resourceful usually, and have operating styles that enable them to exploit opportunities successfully (Miles and Snow 1978; Sabherwal and Chan 2001). These firms have a strong tendency to innovate in terms of new products, processes, and strategies. When OEMs with a prospector orientation establish tight systems integration with customers, they are likely to benefit much more. As theories of systems integration predict, their resourcefulness and proactive approach will help them identify in integrated data and knowledge new opportunities for business growth and innovation. They will also better avail of any digital options (discussed earlier) that such systems integration generates. Thus, prospector orientation will help such OEMs achieve many more benefits from tight customers' systems integration that are likely to outweigh the costs of such integration. Therefore:

P3: The more the OEM pursues a prospector orientation, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Customer Orientation*

OEMs that are strongly customer-oriented are likely to benefit the most from tight systems integration with customers. The very basis of customer orientation is starting all the planning and decision-making based on customer input (Mohr and Sarin 2009; Danneels 2003). Customer-oriented OEMs are more likely to have structures and processes in place that can help analyse, integrate, and respond to customer input (Kohli and Jaworski 1990; Govindrajan, Kopalle, and Danneels 2011). As such, when these OEMs get near real-time information from customers' systems that are well integrated with the OEM's systems, they can then make the best and the quickest use of that input and will be able to respond effectively to customer requirements and demand. Thus, the possibility of getting more business from the customers improves greatly.

Furthermore, strong customer-oriented OEMs are expected to have product development processes that are strongly rooted in customer input (Atuahene-Gima 1995; Noble et al. 2002) which is known to make products more novel and appropriate (Sethi et al. 2001). With integrated

systems, customers closely participate in product design and customisation, and their input becomes available almost instantaneously for the OEM's product designers and other relevant supply chain partners. The OEM can also quickly simulate and test new products jointly with the customers. As a result, those OEMs with high integration with customers are likely to develop more novel, appropriate, and high quality products for customers (Sethi et al. 2001; Sethi et al. 2003).

Such customer-oriented decision-making, responsiveness to demand, and superior new products are likely to enhance the performance of the OEM and its supply chain and bring about more strategic gains. Therefore:

P4: The stronger the customer-orientation of the OEM, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

Customer Factors

For business customer integration in the supply chain to work meaningfully, customers have to have the necessary facilities at their end, as well as the motivation to get actively involved in integration efforts. For effective customer participation, it is important that customers have information technology preparedness (Premkumar and Ramamurthy 1995; Grover 1993) and strong identification with the supply chain (Ashforth and Mael 1989; Min et al. 2008). We have included both business customer IT preparedness and identification with the chain as important customer factors in our model. While trust and commitment play an important role in systems-based relationships and have been examined before (e.g., Premkumar and Ramamurthy 1995), identification is a more fundamental construct and it can influence the level of trust and commitment in a relationship (Ashforth and Mael 1989). Supply chain identity refers to the extent to which business customers feel one with the chain and feel a stake in its success (Ashforth and Mael 1986; Sethi 2000).

- *Information Technology Preparedness*

For integrated systems to work effectively, business customers need to possess systems that have databases, network protocols, and file formats compatible with the OEM's. Customers can successfully establish and operate such a facility only if they already have some level of infrastructure and IT sophistication. Importantly, they need to have the willingness to successfully overcome the challenges posed by the installation of such a system and making it secure. Otherwise, business customers will not be able to effectively integrate their systems with those of the OEM. Thus, if customers do not have technological readiness, implementation of systems integration-related tasks will be hindered. As a result, benefits such as improved demand matching, fast exceptions handling, and joint new product development will not be fully realised. Therefore:

P5: The higher the IT preparedness of the customer, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Identification with the Supply Chain*

The literature in organisational theory suggests that organisational identity plays an important role in managing the firm, developing the firm's strategies, and shaping its behaviours (Ashforth and Mael 1989; Dutton and Dukerich 1991). However, the concept of identity at the level of the supply chain becomes a little more complicated because different constituents of the chain have their own identities. These constituents with different identities are likely to pull the chain in different directions and thus make it difficult to exploit the full potential of systems integration (Mackie and Goethals 1987; Sethi 2000). Some customers' identification with a particular OEM's supply chain may be low for a variety of reasons, including the fact that they buy from multiple supply chains.

Unless business customers identify with the supply chain, it is difficult to avail of the benefits of tight systems integration. Without a sense of identification with the supply chain, customers may not have the trust necessary to give full access to their information and knowledge to the OEM and its supply chain. Nor will such customers be committed enough to establish connections between different information, knowledge, and resources of the OEM and suppliers (Sethi 2000). As a result, the likelihood of improving the performance of the supply chain as well as strategic gains for the supply chain will be reduced and the benefits of systems integration may not be fully realised. In other words, for an integrated supply chain to become a valuable resource, firms involved in integration need to identify with the supply chain. Therefore:

P6: The higher the identification of the customer with the supply chain, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

Product Factors

Depending on the products of the firm, interdependence between the OEM's supply chain and business customers is likely to vary (Clark and Fujimoto 1991; Wheelwright and Clark 1992). Two important factors that can influence such interdependence are: the complexity of the product and the degree to which the product requires customisation (Clark and Fujimoto 1991; Smith and Reinertsen 1991; Novak and Eppinger 2001). Since different levels of systems integration are suitable for different levels of interdependence (Mukhopadhyay 1993; Premkumar et al. 1995), product complexity and the degree of customisation are the variables of interest in this study.

- *Product Complexity*

A high level of systems integration between the supply chain and business customers is likely to be more beneficial, if the firm's products are highly complex (Clark and Fujimoto 1991). Products can be called complex for a variety of reasons, e.g., when they involve several different technologies,

have many intricate parts or subassemblies, or require complicated after-sales service. The design and development of such products requires a great deal of information, knowledge, and interaction among a variety of experts from the supply chain and business customers, and such individuals may not always be physically proximate (Malhotra et al 2001). As suggested by the knowledge-based view of firms, highly integrated systems will help these experts access each other's information and knowledge, which is a key competitive resource (Zahra and George 2000), on a real time basis. They can develop the specifications of the products jointly, work together on different aspects of product design, and ensure through repeated discussions that the products can be quickly and effectively serviced.

Integrated systems will also make it possible to communicate any change in one aspect of the product to others immediately, and to obtain others' feedback on changes very quickly; otherwise there can be mismatches in designs and plans of different experts that may require a lot of rework (Clark and Fujimoto 1991; Smith and Reinertsen 1991). Thus, experts who work on complex products are more likely to develop superior and successful products in a shorter time period if customers' systems are more integrated with the supply chain. Therefore:

P7: The more the complexity of the product, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Product Customisation*

If products require a high degree of customisation, tight integration between the systems of business customers and the OEM's supply chain will be helpful. With interlinked systems, requirements of the business customers (or the requirements of their end customers) can be quickly updated in the OEM's and suppliers' systems. The OEM's and suppliers' systems can immediately come up with customised product specifications or configurations, and these systems, along with customers' systems, can be updated in terms of the new or revised production schedule, new material requirements, and delivery dates. If business customers want to themselves customise products, they can directly access the OEM's and suppliers' systems to configure products as per their requirements. Thus, the supply chain can very quickly respond to these requirements. Such facility with customisation can lead to more business for the supply chain, reduce costs due to the elimination of paper work, and manual updating, thereby not only reducing transaction costs, but also resulting in more customer satisfaction and long-term relationship (Van Hoek et al, 2001). Therefore:

P8: The greater the degree of product customisation, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

Business Environment

Researchers in the area of information systems see an important role of the business environment in influencing the adoption of various computer systems by firms (Larsen 1996). Integrated supply chains are also known to deal better with uncertain environments (Fiala 2005). In addition, the link between the business environment, including competition in the industry, and the effectiveness of customer orientation has been recognised in the literature (Kohli and Jaworski 1990; Danneels and Sethi 2011). As the above streams of research suggest, two aspects of the business environment that appear to have a significant role in influencing supply chains and information systems are: competition in the market and uncertainty in the industry (Premkumar et al. 1994; Grover 1993). As such, we have included these two variables in our model.

- *Market Competition*

To retain an edge in a very competitive marketplace, an OEM needs more aggressive strategies and innovative products. In consensus with the knowledge-based view of firms, a high degree of integration between business customers' and supply chain systems makes it possible to integrate information and knowledge of customers, OEMs, and suppliers. As a result, the likelihood of discovering novel linkages between diverse information, perspectives, and knowledge increases, which is the essence of innovative outcomes (Sethi et al 2001), thereby making integrated systems a valuable firm resource. Superior and innovative strategies and products that will be developed and launched by such integrated chains are likely to lead to better performance for the OEM and the supply chain. Thus**,** an integrated chain becomes a valuable resource for business partners **(**Priem and Swink 2012). Similarly, when competitors rapidly develop aggressive strategies and new products and steadily improve these strategies and products, it will be more appropriate to invest in tightly integrating business customers' and the supply chain's systems. When data and information are exchanged, updated, and made available to decision makers in almost real time, it is likely to lead to quicker development and launch of new products and strategies (Sethi et al. 2003). This speed can be a major source of strategic gains in competitive markets. This reasoning is consistent with the knowledge-based view of a firm, because developing a new product is a knowledge-intensive activity (Danneels 2008) and speed of knowledge exchange is enhanced through integration of business customers in the OEM's supply chain. It has also been argued in the context of manufacturing information systems that firms operating in more competitive environments derive higher benefits from having more integrated information systems (Cowdrick 1989; Spiker et al. 1988). Therefore:

P9: The higher the competition in the OEM's market, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Market Uncertainty*

Similarly, if there is high uncertainty in the OEM's technological and market environments, then the OEM might be better off tightly integrating their systems with business customers' systems (Ireland and Bruce 2000). For example, the industry can have uncertainty in terms of demand (i.e., when demand fluctuates rapidly), product and manufacturing technologies involved (i.e., when technologies are rapidly changing), and customers' response (i.e., when it is not clear how customers or their end customers will respond to firms' strategies and new products). High uncertainty requires a great deal of interaction between the OEM's supply chain and the business customers, so that they can rapidly exchange information and be on the same wavelength about the market and products, and regularly update their shared assumptions (Ireland and Bruce 2000). As uncertain situations evolve, more information may become available, requiring quick changes, which increases the need for integration between the OEM and business customers (Ireland and Bruce 2000). Close linkages between the systems of the OEM's supply chain and customers will make it possible for the two parties to work in an integrated manner without any loss of time. In effect, highly integrated systems will help organisations cope with environmental uncertainty through better and near real-time communication and improved coordination. This is likely to lead to the development of superior strategies and new products in the shortest possible time, and thus help outweigh the costs of systems integration. Therefore:

P10: The higher the uncertainty in the OEM's market, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

OEM's Organisational Factors

The effect of organisational factors has been studied extensively in areas such as information systems, market orientation, and new product development. In information systems research, organisational factors have been found to influence both the adoption of systems as well as their effectiveness in delivering desired outcomes. For example, organisations that allow free exchange of ideas, data, and applications across departmental boundaries benefit more from integrated information systems (Pinsonneault and Kraemer 1993; Grover 1993). However, interdepartmental conflict can hinder free exchange between or among various departments.

Yet another factor that can influence free exchange of information and cooperation is senior management involvement in the creation of information systems integration (Premkumar et al. 1994). Similarly, organisational factors are known to influence both the development of customer orientation in the firm and its effective implementation (Kohli and Jaworski 1990; Jaworski and Kohli 2003). Thus, the two important factors that have the potential of influencing the effectiveness of system integration between the business customer and the OEM and its supply chains can be identified as: (1) the level of conflict between departments of the OEM's organisation, and; (2) the

involvement of the OEM's senior management in the systems integration effort. These two variables are a part of our conceptual model.

- *Interdepartmental Conflict*

If an OEM has strong conflicts between its various departments, it can become quite difficult to avail of the full benefits of integration between business customers' and OEM's systems. Success of integrating OEM's systems with those of business customers' systems requires strong internal integration (Davenport and Brooks 2004). Such strong internal integration requires active participation by representatives of different functional areas, a willingness to openly share information and perspectives with other functional areas, suppliers, and customers, and to make their data, files, and drawings accessible to others. If there is a high degree of conflict between departments, their representatives will hesitate to openly share information and perspectives with individuals from other functional areas. Furthermore, as information is power, functional areas will hesitate to make their information accessible to everyone else in the firm, as this amounts to giving up a part of their power base (Davenport and Short 1990; Grover and Davenport 2001; Kanter 1983; Pfeffer 1981). Therefore, less interdepartmental conflict is needed to ensure effective integration with business customers' systems, which, in turn, is expected to increase the likelihood of enhancing the performance and strategic gains of the supply chain. The IT literature supports the contention that organisations that have a higher degree of cooperation among departments, derive more benefits from integrated information systems (Grover 1993). Therefore:

P11: The lower the level of interdepartmental conflict in the OEM's organisation, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Senior Management Involvement*

If the senior management in a firm gets involved in the systems integration project, the organisation is likely to gain much higher benefits of such integration. As included in the discussion on the levels of business customers' information systems integration in supply chain, the implementation of a highly sophisticated system is a big challenge, which involves major changes in the way in which the OEM and its supply chain have operated so far. There is bound to be resistance to such change (Kanter 1983; Frohlich 2002). Senior management's active involvement will help to overcome some of this resistance. Furthermore, such a complicated project will require a great deal of support and resources of a variety of individuals, in both the OEM's and business partners' firms. However, not everybody will willingly offer such support and resources, particularly if they do not stand to gain anything, or are likely to lose some of their existing control and authority because of the new system**s** (Kanter 1983). When the OEM's senior management is actively involved, it becomes difficult for people to hold back resources and obstruct the progress of systems integration (Sethi et al 2001). As a result, a highly integrated system is more likely to be successfully

implemented, leading to improved performance and strategic gains. There is some indirect evidence in the literature that suggests that the involvement of senior management in the implementation of sophisticated IT systems is a major factor in their success (Kweku 1997). Therefore:

P12: The higher the senior management involvement, the greater the net benefit of high levels of business customers' information systems integration into the supply chain.

Information Technology Factors

Obviously, information technology plays a pivotal role in enabling the integration of business customers' systems with those of an OEM, or with the entire supply chain (Yusuf et al. 2004; Mondrango et al. 2004; Lau et al. 2003). One IT factor that we have identified as playing a critical role in the success of integration of IT efforts is the OEM's supply chain information technology infrastructure involved in the integration effort (Gunasekaran and Ngai 2004; Sakaguchi and Nicovich 2004). The other IT factor of interest is IT embeddedness. IT researchers have applied Uzzi's (1996) concept of social embeddedness in inter-firm relationships to the strategic use of EDI (Chatfield and Yetton 2000). IT embeddedness is a measure of how critical an organisation's information systems are in managing interdependence in supply chains (Sethi et al 2003). Inter-organisational systems not only reduce transaction costs (Williamson 2005) for business partners, but, as theorised by the knowledge-based view of firms (Grant 1997; Eisenhardt and Santos 2002), they also help them share knowledge. Furthermore, these systems become a valuable resource for firms as the level of competition itself shifts from firms to supply chain. Firms that are characterised by high IT embeddedness exploit the power of an inter-organisational information systems toward quick dissemination of information and mutual problem solving. Therefore, we focus on the IT infrastructure and IT embeddedness in OEMs' supply chains as two technology-related variables of interest.

- *Information Technology Infrastructure*

Existence of a well-developed information technology infrastructure (i.e., hardware, software, networks, and IT experts) is crucial for the OEM's supply chain to exploit the full benefits of high levels of business customers' systems integration. In particular, higher levels of integration require computer systems and architectures that inter-operate with one another. Since modern large firms contain a large number of systems such as ERP, CRM, SCM, as well as legacy systems, high calibre IT professionals are required to integrate and secure them. Unless a well-developed IT technical and human infrastructure exists in the OEM's supply chain, the integration of business customers' systems with an OEM's or its business partners systems is not likely to work at its full potential. The linkage between the quality of IT infrastructure and the success of sophisticated information systems has been established in the IT literature (Brancheau 1996; Kweku 1997; Karimi et al 1996). Therefore:

P13: The more sophisticated the information infrastructure in the OEM's supply chain is, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

- *Information Technology Embeddedness*

If information systems are already highly embedded in an OEM's supply chain processes, operations, and internal interactions, the benefits of higher levels of customers' information systems integration with the supply chain systems are likely to be greater. In the case of highly embedded information systems, supply chain professionals already engage in a great deal of interaction, exchange of sensitive information, and joint problem solving online (Chatfield and Yetton, 2000). These professionals are more likely to understand each other's online communication, data, information, and knowledge exchange, and they can quickly grasp the context and the significance of the data, information, and knowledge exchange. Furthermore, when information systems are highly embedded in a supply chain, professionals can understand almost intuitively how and what it takes to automate various inter-organisational business processes in integrated supply chain systems (Sethi et al 2003). They also grasp what type of adjustments are needed in their work methods, processes, and social systems to make the integration smooth and successful (Sethi et al. 2003). Thus, when information systems are highly embedded in a supply chain, a deeper integration of business customer's information systems is likely to lead to better and faster exchange of data, information, and knowledge and thus result in more benefits. Therefore:

P14: The more embedded the information technology in the OEM's supply chain is, the greater the net benefit of high levels of business customers' information systems integration in the supply chain.

Discussion

This paper has offered a way to conceptualise the integration of customers' systems with those of supply chain systems in the B-to-B context. It has elaborated on this conceptualisation with the help of three levels of customers' systems integration. Furthermore, the paper highlights how such systems' integration improves performance and strategic gains for the OEM and its supply chain. Finally, the paper identifies the conditions that need to exist for a supply chain to exploit the full benefits of integrating customers' systems, and examines how the relationship between systems integration and its outcomes is affected by such conditions or contextual factors.

The important message of this framework is that, despite all the enthusiasm in the literature about the integration of customers' systems in supply chains, it needs to be remembered that high levels of such integration in B-to-B markets is expensive to implement and successfully run and, thus, may not be suitable for every firm or supply chain and situation. Furthermore, it is equally crucial

to bear in mind that unless appropriate conditions exist within and outside the OEM's organisation and the supply chain, investment in customers' systems integration may not be beneficial.

Consider the initiative of Boeing to integrate airlines into its supply chain system. Such integration is justified for a variety of reasons. As our conceptual model suggests, the company faced stiff competition from its rival Airbus, as its products are very complex, and require a high degree of customisation, and as it relies on external partners for the design of its parts and sub-assemblies. The company is also a pioneer in the use of IT tools for integration and collaboration. These factors make it worthwhile to have high levels of business customers' information systems integration in Boeing's supply chain.

Next we discuss the research and managerial implications of our conceptualisation.

Research Implications

From a research perspective, our framework enhances current thinking in the area of B-to-B relationships and the integration of business customers' information systems in an OEM's supply chain. When the B-to-B literature generally discusses relationships, it focusses on issues that are more applicable in a traditional, non-Web world. However, we have argued here that in the emerging B-to-B environment, relationship marketing needs to be viewed in the light of information systems integration. As the trend suggests, a large number of business relationships will soon be mediated through information systems integration. There thus arises a need for a new way of conceptualizing B-to-B relationships. In this paper, we have highlighted how customer systems integration changes the very relationship between the OEM's supply chain and their business customers. Therefore, in effect, our paper lays the foundation for developing new concepts in the field of information systems-mediated relationship marketing.

Regarding information systems and customer relationships, as mentioned earlier, the majority of the research work so far relates to point-of-sale data visibility to chain partners, CRM systems, or customer data mining (Chen and Ching 2004; Chan 2005; Zahay and Griffin 2004, Liang and Tanniru, 2007). However, what remained to be understood and examined was what the integration of business customers' information systems in an OEM's supply chain systems truly means and entails. In the B-to-B context, our paper provides a conceptualisation of the integration of business customers' information systems in an OEM's supply chain systems. These systems involve alignment and integration of business processes, data, and applications of the OEM and its supply chain with that of the customer. We have also shown how information systems can have different levels of integration of business customer's information systems with an OEM's supply chain system. However, our framework should be considered only a beginning in the important and under-researched area of integration of business customer's information systems with an OEM's supply chain system. Much more research is needed for the proper development of this area.

Furthermore, while information systems researchers have examined inter-organisational systems in the context of EDI, they have focussed more on data interchange between two businesses. However, systems-mediated relationship between the supply chain and customers is much more complex and multidimensional. In addition to data, processes need to be aligned and applications need to be integrated between the supply chain and customers. Our conceptualisation of systems integration captures this new complexity and sophistication in inter-organisational systems. Additionally, while the literature acknowledges that certain organisational factors can affect the performance of inter-organisational information systems, many other factors that can influence the effectiveness of the relationship between a supply chain and its customers remain to be considered. For example, the customer-orientation of the OEM can play an important role in improving the effectiveness of integration of business customer's information systems with their own supply chain systems. Similarly, customers' identification with the supply chain becomes a critical factor when the focus is on forming more complex, multidimensional, and long-term relationships. Thus, our paper has identified and introduced to the B-to-B marketing literature, several new contextual factors that are necessary to make integration of business customer's information systems with OEM's supply chain systems effective and gainful.

Managerial Implications

Our paper offers managers a new way of looking at relationships with business customers. Managers need to realise that with the introduction of integrated information systems, the landscape of business customer relationships undergoes a big change: OEM firms now have a new and powerful tool to relate with their business customers. Those who create appropriate conditions in their organisations and supply chains to leverage these IT-enabled relationships will stand to gain competitive advantage in the marketplace. For example, investment in IT that integrates business customers in a supply chain can create digital options (as it did for ITC in their e-choupal initiative as discussed earlier).

In this new B-to-B context, managers need to reconsider the traditional concepts of B-to-B relationships. For example, the ability to form integrated systems-based relationships with customers is expected to emerge as an important basis of segmenting business customers (Zahay and Peltier 2008), while some traditional basis of segmentation such as price sensitivity of customers may become less important. Some firms are already using this approach to segment business customers (Zahay and Peltier 2008). Once an OEM forms a highly integrated relationship with the customer, the customer may gain so much from it in terms of net savings, resulting competitive gains and improvement in its market performance, that the price may become a less important issue.

Some customers will continue to have a low level of identification with the OEM's supply chain. The level of trust needed to integrate the IT systems with the OEM's supply chain will thus remain

low for such customers. Furthermore, in most cases, a high level of identification with the OEM's supply chain is not expected to develop overnight, but it is likely to be a gradual process. The OEM may first form a simple non-Web relationship with a skeptical customer and gradually take small steps to give the confidence to the customer that it will watch and protect the interests of the customer. Management of such a relationship may be taken over by senior executives in the OEM's organisation to facilitate the development of the necessary confidence.

Furthermore, our framework advises managers that before integrating customer's information systems with their supply chain's systems, they need to assess the level of integration needed in the supply chain. Managers need to keep in mind the fact that while higher levels of customer's information systems integration has the potential of increasing the efficiency, customer service, and competitive advantage of firms, there is a cost involved in creating such systems. If conditions discussed in this paper are not present in their firm or in their supply chain, then customers' systems integration efforts will largely waste organisational resources.

Additionally, managers will do well to keep in mind that there are major differences between customer-oriented and supplier-oriented supply chain systems. This will help them to acquire and install the right system for their given situation. For example, managers need to be aware of the fact that the amount of influence an OEM will have over the supplier will generally be more than that which they will have over their business customers. Therefore, they will not be able to persuade as effectively the business customers to adopt information systems that integrate with their own information systems as much as they will be able to persuade their suppliers. Therefore, in some cases the OEM will have to do without the desired level of systems integration with their business customers. Furthermore, as discussed earlier, when there is integration of information systems, there is less opportunistic behavior on the part of the OEM and the customer (Clemons et al 1993, Patnayakuni et al. 2006). On the other hand, one does not really need integrated systems to make the supplier-OEM relationship less opportunistic and more collaborative. Such relationships can be collaborative even without setting up integrated systems, for example, as implemented by Toyota and its suppliers (Liker and Choi 2004).

Supply chain systems that are oriented toward customers will also differ significantly from supplier oriented systems in terms of their functionality (Sethi et al 2003; Trebilcock 2014). For example, while reverse auctions are quite popular with suppliers, with customers these systems will predominantly be forward auction systems. As discussed in the case of the Electronics Manufacturer, supply chain systems were geared toward demand fulfilment, as well as the handling of exceptional situations. With business customers, that level of sophistication will not be needed, and business customers will merely need to be intimated about exceptional situations that may arise at the OEM's end. In other words, the level of information systems sophistication in the two cases will be different. Furthermore, in some cases of new product development, the input of business customers may be the starting point (for example, in the case of specialised construction equipment that a business customer may require). In such cases, customer-oriented supply chain

systems will be focussed on integrating OEM's design tools with those of business customers' systems, while supplier-oriented supply chain systems will focus on the timely distribution of the product and component designs. Another important distinction between the two types of supply chain systems will be that the supplier-oriented supply chain systems will tend to be more integrated in terms of the warehouse management capability of the OEM (so that in-bound deliveries are stored in the warehouse efficiently). In customer-oriented supply chain systems, outbound logistics (in terms of timely and efficient packet tracking) will be far more important. Furthermore, OEMs will be interested in implementing display and shelf-space simulation and management software with their retail business customers (such as Wal-Mart), but such a capability will be unnecessary vis-à-vis their suppliers. There is yet another significant difference between the two supply chain systems with regards to the substantially different capabilities of Customer Relationship Management (CRM) software and Supplier Relationship Management (SRM) software. CRM basically deals with the software's ability to organise, synchronise, and automate customer data. Such data can be collected at an arm's-length from the business customer (for example, just by looking at business enquiries or the purchase history of a business customer). SRM, which requires systematic assessment of suppliers' assets and capabilities, involves working with suppliers, and therefore will necessitate the need for strategic planning and managing interactions with suppliers. Compared to CRM, SRM requires a more thorough understanding, collaboration, and reciprocal relationship between the two parties. In effect, as the above discussion suggests, supplier-oriented and customer-oriented systems are quite different from each other in terms of level of sophistication and functionality. Managers would be better off paying attention to such differences. Some major customer-oriented and supplier-oriented supply chain systems are reviewed in Appendix 1.

References

Alavi, M. and Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, 107-136.

Albert, T. C., Goes, B., and Gupta, A. (2004). GIST: A model for design and management of content and interactivity of customer-centric web sites. *MIS Quarterly, 28, 2,* 161-182.

Angeles, R. (2000). Revisiting the role of Internet-EDI in the current electronic commerce scene. *Logistics Information Management, 13, 1,* 45-57.

Asgekar, V. (2004). The demand driven supply network. *Supply Chain Management Review, 8, 3,* 15-16.

Ashforth, B. E. and Mael, F. (1989). Social identity theory and the organization. *Academy of Management Review, 14,* 20-39.

Atuahene-Gima, K. (1995). An exploratory analysis of the impact of market orientation on new product performance: A contingency approach. *Journal of Product Innovation Management, 12,* 275-293.

Bacheldor, B. (2004). Boeing's flight plan. *InformationWeek, 20-21.*

Bakos, J. Y. (1987). Interorganizational information systems: strategic opportunities for competition and cooperation. *MIT Sloan School of Management Ph. D. thesis.*

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17, 1,* 99-120.

Brancheau, J. C. (1996). Key issues in information systems management: 1994-95, SIM Delphi results. *MIS Quarterly 20, 2,* 225-243.

Bowonder, B., Gupta, V., and Singh, A. (2003). Developing a rural market e-hub: The case study of e-Choupal experience of ITC. *Planning Commission of India.*

Brock, J. R. (2001). Supply-chain success. *InfoWorld.*

Campbel, J and Sankaran, J**.** (2005)**.** An inductive framework for enhancing supply chain integration. *International Journal of Production Research, 43, 16,* 3321-3351.

Cash, J. I. and Konsynski, B. R. (1985). IS redraws competitive boundaries. *Harvard Business Review*, *63*(2), 134-142.

Chan, J. O. (2005). Toward a unified view of customer relationship management. *Journal of American Academy of Business, 6, 1,* 32-38.

Chatfield, A.T. and Yetton, P. (2000). Strategic payoff from EDI as a function of EDI embeddedness. *Journal of Management Information Systems, 16, 4,* 195-224.

Chen, J. and Ching, R. K. H. (2004). An empirical study of the relationship of IT intensity and organizational absorptive capacity on CRM performance. *Journal of Global Information Management, 12, 1,* 1-17.

Clark, K. B., and Fujimoto, T. (1991). *Product development performance: Strategy, organization, and management in the world auto industry*. Harvard Business Press.

Clemons, E. K., Reddi, S. P., and Row, M. C. (1992). The Impact of Information Technology on the Organization of Economic Activity: The "Move to the Middle" Hypothesis. *Journal of Management Information Systems, 10(2),* 9-35.

Cowdrick, R. M. (1989). Developing and implementing CIM systems for process manufacturers and distributors. *Computers and Industrial Engineering, 17, 1,* 7-11.

Danneels, E. (2003). Tight-loose coupling with customers: The enactment of customer orientation. *Strategic Management Journal, 24*(6), 559.

Danneels, E. (2008). Organizational antecedents of second-order competences. *Strategic Management Journal*, *29*(5), 519-543.

Danneels, E. and Sethi, R. (2011). New product exploration under environmental turbulence. *Organization Science*, *22*(4), 1026-1039.

Davenport, T. H. and Brooks, J. D. (2004). Enterprise systems and the supply chain. *Journal of Enterprise Information Management, 17, 1,* 8-19.

Davenport, T.H. and Short J. (1990). The new industrial engineering: information technology and business process redesign. *Sloan Management Review 31, 4,* 11-27.

Dhillon, G. (2008). Organizational competence in harnessing IT: a case study, *Information & Management*, 45(5), pp 297-303.

Dutton, J. E. and J. M. Dukerich. (1991). Keeping an eye on the mirror: Image and identity in organizational adaptation. *Academy of Management Review, 34, 3,* 517-554.

Dyer, J. H., and Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, *23*(4), 660-679.

Eisenhardt, K. M. and Santos, F. M. (2002). Knowledge-based view: A new theory of strategy. *Handbook of ~~s~~Strategy and ~~m~~Management*, 139-164.

El Sawy, O. A., Malhotra, A., and Gosain, S. (1999). IT-intensive value innovation in the electronics in the electronic economy: Insights from Marshall Industries. *MIS Quarterly, 23, 3,* 305-335.

Esper, T. L., Ellinger, A. E., Stank, T. P., Flint, D. J., and Moon, M. (2010). Demand and supply integration: a conceptual framework of value creation through knowledge management. *Journal of the Academy of Marketing Science*, *38*(1), 5-18.

Fabian, F and Dhillon, G. (2007). Losing Managerial Discretion: The Unexplored Risk of Collaborative Information Sharing, *Journal of Information Science and Technology*, 4(1), pp. 47-60.

Ferguson, R. B. (2004). Rightsizing design; Boeing, Intermec pick management apps that fit their needs. *eWeek, 21, 8, 27.*

Fiala, P. *(2005).* Information sharing in supply chains. *Omega, 33, 5,* 419 – 423.

Fisher, M. L. (1997). What is the right supply chain for your product? *Harvard Business Review*, 105-116.

Frohlich, M. T. (2002). E-Integration in the Supply Chain: Barriers and Performance. *Decision Sciences, 33(4),* 537-556.

Gandhi, A., Magar, C., and Roberts, R. (2014). How technology can drive the next wave of mass customization. *Business Technology Office*, 1-8.

Govindarajan, V., Kopalle, P. K., and Danneels, E. (2011). The effects of mainstream and emerging customer orientations on radical and disruptive innovations. *Journal of Product Innovation Management*, *28*(s1), 121-132.

Grant, R. M. (1997). The knowledge-based view of the firm: implications for management practice. *Long Range Planning, 30(3),* 450-454.

Greising, D. and Johnsson, J. (2007). Behind Boeing's 787 delays. *Chicago Tribune*, *10*.

Grover, V. (1993). An empirically derived model for the adoption of customer-based interorganizational systems. *Decision Sciences, 24, 3,* 603-649.

Grover, V. & Davenport, T.H. (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information Systems 18, 1,* 5-21.

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, *38*(1), 85-112.

Gulati, R. and Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly, 43*(4), 781-814.

Gunasekaran, A. and Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operations Research, 159,* 269-295.

Hilletofth, P. and Lättilä, L. (2012). Agent based decision support in the supply chain context. *Industrial Management & Data Systems, 112(8),* 1217-1235.

Hillman, A. J., Withers, M. C., and Collins, B. J. (2009). Resource dependence theory: A review. *Journal of Management, 35(6),* 1404-1427.

Hormozi, A. M. and Giles, S. (2004). Data mining: A competitive weapon for banking and retail industries. *Information Systems Management, 21, 2,* 62-71.

Hult, G. T. M., Ketchen, D. J., and Slater, S. F. (2004). Information processing, knowledge development, and strategic supply chain performance. *Academy of Management Journal*, *47*(2), 241-253.

Hutt, M. D. and Speh, T.W. (2001). *Business Marketing Management.* New York: Dryden Press.

Van Hoek, R., Harrison, A., and Christopher, M. (2001). Measuring agile capabilities in the supply chain. *International Journal of Operations & Production Management*, *21*(1/2), 126-148.

Irani, Z. (2002). Invited viewpoint: Critical evaluation and integration of information systems. *Business Process Management Journal, 8, 4,* 314-317.

Iacovou, C., Benbasat, I., and Dexter, A. S. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly*, 19, 4, 465-485.

Ireland, R. and Bruce, R. (2000). CPFR: Only the beginning of collaboration. *Supply Chain Management Review*, 80-88.

Iyer, L., Singh, R., and Salam, A. F. (2005). Intelligent agents to support information sharing in B2B E-marketplace. *Information Systems Management, 22, 3,* 37-49.

Jaworski, B. and Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *Journal of Marketing, 57,* 53-70.

Johnston, H. R. and Vitale, M. R. (1988). Creating competitive advantage with interorganizational information systems. *MIS Quarterly*, 153-165.

Kanter, R. M. (1983*). Change Masters.* New York: Simon and Schuster.

Karimi, J., Gupta, Y., and Somer, T. M. (1996). Impact of competitive strategy and information technology maturity on firms' strategic response to globalization. *Journal of Management Information Systems, 12, 4,* 55-89.

Kleeberg, M., Zirpins, C., and Kirchner, H. (2014). Information Systems Integration in the Cloud: Scenarios, Challenges and Technology Trends. In *Future Business Software*, 39-54.

Kohli, A. K. and Jaworski, B. J. (1990). Market orientation: The construct, research propositions, and managerial implications. *Journal of Marketing, 54,* 1-18.

Konicki, S. (2000). A changing marketplace landscape? *InformationWeek, 20.*

Konsynski, B. R. (1993). Strategic control in the extended enterprise. *IBM Systems Journal*, *32*(1), 111-142.

Kuan, K. K. Y. and Chau, Y. K. (2001). A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. *Information and Management, 38,* 507-521.

Kumar, R. L. (2004). A framework for assessing the business value of Information Technology infrastructures. *Journal of Management Information Systems, 21, 2,* 11-32.

Kumar, R. L. and Crook, C. W. (1999). A multi-disciplinary framework for the management of interorganizational systems. *ACM SIGMIS Database*, *30*(1), 22-37.

Kumar, K. and Van Dissel, H. G. (1996). Sustainable collaboration: managing conflict and cooperation in interorganizational systems. *MIS Quarterly*, 279-300.

Kweku, E. (1997). Critical issues in abandoned information systems development projects. *Communications of the ACM, 40, 9,* 74-80.

Larsen, T. (1996). Global information technology utilization trends: A wide or narrow road toward the future? *Journal of Global Information Management, 3, 2,* 3-4.

Lau, H. C. W., Wong, C. W. Y., Pun, K. F., and Chin, K. S. (2003). Virtual agent modeling of an agile supply chain infrastructure. *Management Decision, 41, 7,* 625-636.

Lee, J., Siau, K., and Hong, S. (2003). Enterprise integration with ERP and EAI. *Communications of the ACM, 46, 2,* 54-60.

Liang, T. P. and Tanniru, M. (2006). Special section: customer-centric information systems. *Journal of Management Information Systems*, *23*(3), 9-15.

Lichtenthal, J. D. and Eliaz, S. (2003). Internet integration in business marketing tactics. *Industrial Marketing Management*, *32*(1), 3-13.

Liker, J. and Choi, T. (2004). Building Deep Supplier Relationships, *Harvard Business Review,* 82 (12), 104-113.

Mackie, D. M. and Goethals, R. G. (1987). Individual and Group Goals. In Hendrick, C. (ed.). *Review of Personality and Social Psychology*, 144-66.

Maier, J. L., Rainer Jr, R. K., and Snyder, C. A. (1997). Environmental scanning for information technology: an empirical investigation. *Journal of Management Information Systems*, 177-200.

Malhotra, A., Majchrzak, A., Carman, R., and Lott, V. (2001). Radical innovation without collocation: A case study at Boeing-Rocketdyne. *MIS Quarterly, 25, 2,* 229-249.

Malhotra, A., Gosain, S., and El Sawy, Q. A. (2005). Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *MIS Quarterly 29, 1,* 145-187.

Malone, T. W., Yates, J., and Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, *30*(6), 484-497.

Margretta, J. F. (1998). Global, and Entrepreneurial: Supply Chain Management, Hong Kong Style. *Harvard Business Review*, 103-104.

Mattia, A. (2012). A Multi-Dimensional View of Agent-Based Decisions in Supply Chain Management. *Communications of the IBIMA*.

Miles, R.E. and Snow, C.G. (1978). *Organizational Strategy, Structure, and Process.* New York: McGraw Hill.

Min, S., Kim, S. K., and Chen, H. (2008). Developing social identity and social capital for supply chain management. *Journal of Business Logistics*, *29*(1), 283-304.

Mohr, J. J., and Sarin, S. (2009). Drucker's insights on market orientation and innovation: implications for emerging areas in high-technology marketing. *Journal of the Academy of Marketing Science*, *37*(1), 85-96.

Mondrango, A. E. C, Lyons, A. C., and Kehoe, D. F. (2004). Assessing the value of information in supporting agility in high-tech manufacturing enterprises. *International Journal of Operations and Production Management, 24, 11, 12,* 1219-1242.

Mukhopadhyay, T. (1993). Assessing the economic impacts of data interchange technology. In Banker, R.D., Kaufman, R.J. and Mahmood, M.A. (eds.). *Strategic Information Technology Management: Perspectives on Organizational growth and Competitive Advantage,* 241-264, Hershey, PA: IGI Publishing.

Nink, M. (2013). B2Bs Win by Building Relationships, Not Selling on Price. http://www.gallup.com/businessjournal/165389/b2bs-win-building-relationships-not-selling-price.aspx

Noble, Charles H., Sinha, R. K., & Kumar, A. (2002). Market orientation and alternative strategic orientations: A longitudinal assessment of performance implications. *Journal of Marketing, 66,* 20-35.

Novak, *S.* and Eppinger, S. D. (2001). Sourcing by design: Product complexity and the supply chain. *Management Science, 47,* 189-204.

O' Callaghan, R., Kaufmann, P. J., and Konsynski, B. R. (1992). Adoption correlates and share effects of electronic data interchange systems in marketing channels. *Journal of Marketing*, 45-56.

Panko, R. and Panko, J. (2010). *Business Data Networks and Telecommunications.* Prentice Hall Press.

Pant, S., Sethi, R., and Bhandari, M. (2003). Making sense of the supply chain landscape: an implementation framework. *International Journal of Information Management, 23,* 201–221.

Patnayakuni, R., Rai, A., and Seth, N. (2006). Relational antecedents of information flow integration for supply chain coordination. *Journal of Management Information Systems, 23(1),* 13-49.

Pfeffer, J. (1981). *Power in Organizations.* Massachusetts: Pitman Publishing.

Pfeffer, J. and Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective.* Stanford University Press.

Pinsonneault, A. and Kraemer, K. (1993). The impact of information technology on middle managers. *MIS Quarterly, 17,* 271-288.

Plakoyiannaki, E. and Tzokas, N. (2002). Customer relationship management: A capabilities portfolio perspective. *Journal of Database Management, 9, 3,* 228-237.

Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review, 79, 3,* 62-78.

Post, G. V., Kagan, A., and Lau, K. (1995). A modeling approach to evaluating strategic uses of information technology. *Journal of Management Information Systems, 12, 2,* 161-188.

Premkumar, G. P. (2000). Interorganization systems and supply chain management. *Information Systems Management*, *17*(3), 1-14.

Premkumar, G., Ramamurthy, K., & Nilakanta, S. (1994). Implementation of electronic data interchange: An innovation diffusion perspective. *Journal of Management Information Systems, 11, 2,* 157-176.

Premkumar, G. and Ramamurthy, K. (1995). The role of interorganizational and organizational factors on the decision mode for adoption of interorganizational systems. *Decision Sciences, 26, 3,* 303-335.

Priem, R. L. and Swink, M. (2012). A Demand-side Perspective on Supply Chain Management. *Journal of Supply Chain Management*, *48*(2), 7-13.

Ravichandran*,* T. and Lertwongsatien, C. (2005). Effect of information system resources and capabilities on firm performance: A resource-based perspective**.** *Journal of Management Information Systems, 21, 4,* 237-256.

Ravichandran, T., Pant, S., and Chatterjee, D. (2007). Impact of industry structure and product characteristics on the structure of B2B vertical hubs. *Engineering Management, IEEE Transactions on*, *54*(3), 506-521.

Ray, G., Muhana, W. A., and Barney, J. B. (2005). Information technology and the performance of the customer service process: A resource-based analysis. *MIS Quarterly, 29, 4,* 625-652.

Rosenzweig, E. D., Roth A.V., and Dean, J.W. (2003). The influence of an integration strategy on competitive capabilities and business performance: An exploratory study of consumer products manufacturers. *Journal of Operations Management, 21, 4,* 437-456.

Sabherwal, R., and Chan, Y. E. (2001). Alignment between business and IS strategies: a study of prospectors, analyzers, and defenders. *Information Systems Research, 12(1),* 11-33.

Saeed, K. A., Grover, V., and Hwang, Y. (2005). The relationship of E-commerce competence to customer value and firm performance: An empirical investigation**.** *Journal of Management Information Systems, 22, 1,* 223-256.

Sakaguchi*,* T.*,* Nicovich*, S. G.,* and Dibrell, C. C. (2004). Empirical evaluation of an integrated supply chain model for small and medium sized firms**.** *Information Resources Management Journal, 17, 3,* 1-20.

Sambamurthy, V., Bharadwaj, A., and Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly, 27, 2,* 237-263.

Sass, C. J. and Keefe, T. A. (1998). MIS for strategic planning and a competitive edge. *Journal of Systems Management, 39, 6,* 14-18.

Sethi, R., Pant, S., and Sethi, A. (2003). Web-based product development systems integration and new product outcomes: A conceptual framework. *Journal of Product Innovation Management, 20, 1,* 37-55.

Sethi, R. (2000). Superordinate identity in cross-functional product development teams: Its effect on new product performance and its antecedents. *Journal of the Academy of Marketing Science, 28,* 330-44.

Sethi, R., Smith, D.C., and Park, C.W. (2001). The effect of cross-functional product development teams on the innovativeness of new consumer products. *Journal of Marketing Research, 38,* 73-85.

Singh, R., Salam, A., and Iyer, L. (2005). Intelligent agents in e-supply chains. *Communications of the ACM, 48, 6,* 109-115.

Smith, G. and Reinertsen, D.G. (1991*). Developing Products in Half the Time.* New York: Van Norstrand.

Spiker, B. K., Peterson, S. J., and Paul, K. B. (1988). CIM comes to the process industries. *Mechanical Engineering, 110, 3,* 57-59.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? MIS Quarterly, 28, 1, 45-84.

Team, T. (2014). Boeing leads Airbus in the race for new commercial airplane orders in 2014, *Forbes,* August 18.

Themistocleous, M., Irani, Z., and Love, E. D. (2004). Evaluating the integration of supply chain information systems: A case study. *European Journal of Operations Research, 159,* 393-405.

Trebilcock, B. (2104). 2014 Top 20 Global Supply Chain Management Software Suppliers, Web Reference: http://www.supplychain247.com/article/2014_top_20_global_supply_chain_management_software_suppliers

Uzzi, B. (1996). The source and consequences for embeddedness for the economic performance of organizations: The network effect. *American Sociological Review, 61,* 674-498.

Waurzyniak, P. (2004). Visualizing the Virtual Factory. *Manufacturing Engineering, 132, 4,* 49-56.

Wheelwright, S. C., & Clark, K. B. (1992). *Revolutionizing Product Development.* New York: The Free Press.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5(2),* 171-180.

Williamson, O. E. (2005). *Transaction Cost Economics*. Springer: US.

Williams, A. (2005). PLM Umbrella: Dassault Systems offers solutions for all levels of designers. *Catalyst,* 40-41.

Yusuf, Y. Y., Gunasekaran, A., Adeleye, E. O., and Sivayoganathan, K. (2004). Agile supply chain capabilities: Determinants of competitive objectives. *European Journal of Operational Research, 159, 2,* 379-392.

Zahay, D. and Griffin, A. (2004). Customer learning processes, strategy selection and performance in B-to-B service firms. *Decision Sciences, 35,* 169-203.

Zahay D. and Peltier, J (2008). Interactive strategy formation: Organizational and entrepreneurial factors related to effective customer information systems practices in B2B firms. *Industrial Marketing Management, 37, 2* 191–205.

Zahra, S. A. and George, G. (2000, August). Absorptive Capacity: A Review and Reconceptualization. In *Academy of Management Proceedings* (Vol. 2000, No. 1, pp. K1-K6). Academy of Management.

Zhao, L., Huo, B., Sun, L., and Zhao, X. (2013). The impact of supply chain risk on supply chain integration and company performance: a global investigation. *Supply Chain Management: An International Journal, 18(2),* 115-131.

Zhao, X., Huo, B., Selen, W., and Yeung, J. H. Y. (2011). The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management, 29(1),* 17-32.

Zhu, K., Kreamer, K. L., and Xu, Sea. (2002). A cross-country study of electronic business adoption using technology-organization-environment framework. *Twenty-Third International Conference on Information Systems*, 337-348.

Appendix A

Customer-Oriented	Supplier-Oriented *
1. Metaphase from EDS (Previously SDRC)[1] *Functionality: Product Data Management that enable data management and control, product definition, automation of NPD processes, collaboration with business customers* 2. Windchill from PTC[1] *Functionality: Web-based suite of collaborative software applications for product development; enables integration of NPD processes and product data with business customers* 3. Enovia from IBM[1] *Functionality: Web-based suite of collaborative software applications for product development; enables integration of NPD processes and product data with business customers* 4. Darwin from Nasa[1] *Functionality: Allows business customers such as aircraft manufacturers to carry out wind-tunnel testing of aircraft parts remotely at NASA facilities* 5. SalesForce[2] *Functionality: Sales force automation and CRM; B2B prospecting; Customer Support; B2B Marketing Automation; Customer Support & Helpdesk* 6. Siebel Sales Application (Now, acquired by Oracle)[3] *Functionality: A complete suite of applications to enable automation and integration of all sales-related activities with business customers and for CRM*	1. Supply Chain Management (SCM) from SAP and Oracle *Functionality: Supply Chain Planning, Manufacturing Execution, Materials Requirements Planning, Transportation Management Systems* 2. Supply Chain Management (SCM) from JDA Software *Functionality: Supply Chain Planning, Transportation Management Systems* 3. Supply Chain Management (SCM) from Manhattan Associates *Functionality: Supply Chain Planning, Manufacturing Execution, Transportation Management Systems* 4. Supply Chain Management (SCM) from Epicor** *Functionality: Supply Chain Planning, Manufacturing Execution, Transportation Management Systems* 5. Supplier Relationship Management (SRM) Software: Fishbowl, QStart, SNAP, Procurify, 3PLCentral, ECSourcingGroup, ShippersEdge, Novatus, and AMT *Functionality: Supplier Contact Management, Supplier Contracts by Facility and Product, Vendor Request for Quote (RFQ) Processing, Pricing History by Supplier, Supplier Performance Management*
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1. Source: Sethi, R., Pant, S., and Sethi, A. (2003). Web-based product development systems integration and new product outcomes: A conceptual framework. *Journal of Product Innovation Management, 20, 1,* 37-55. 2. Source: http://www.salesforce.com 3. Source: http://www.oracle.com/us/products/applications/siebel/sales/overview/index.html	* Source: Top 10 Most Reviewed Supplier Relationship Management Software Systems http://www.softwareadvice.com/scm/supplier-relationship-management-software-comparison/ ** Source: Top 20 Global Supply Chain Management Software Suppliers http://www.supplychain247.com/article/2014_top_20_global_supply_chain_management_software_suppliers

Major Supply Chain System Software Packages