

# TOWARD A SUPPLY CHAIN COLLABORATION IN THE E-BUSINESS ERA FOR THE CONSTRUCTION INDUSTRY

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**Abstract:** Traditional business partnerships are changing in response to technology advancements and business innovations. Many companies have already reengineered their internal processes, and now the focus has shifted to their trading partners. With network connectivity, supply chain integration is the core strategic competence that enables many companies to act as one. A supply chain represents the cross-functional integration of activities that cross the borders of individual companies. This feature is very important in the construction industry, because many firms must collaborate intensively throughout a project life cycle. The issues involved in selecting e-supply chain partners extend beyond choosing a trading partner or a contractor and must include configuring the business-to-business collaboration among the partners. In the future, supply chains, rather than enterprises (architect, engineer, construction contractor, manufacturer, and supplier), will compete with each other. There will be no isolated islands of automation, and the future of business applications will support collaborative commerce (C-Commerce). The e-commerce supply chain scheme enables a dynamic “virtual construction team” to fulfill many mission-critical business processes throughout a project life cycle, and it will undoubtedly be the best business solution for the new millennium.

Keywords: IT (Information Technology), BPR (Business Process Reengineering), SCM (Supply Chain Management), CM (Construction Management)

## 1. EMERGING STRATEGIC VISION IN THE E-BUSINESS ERA

Today, economic forces and heightened competitive pressures are driving organizations to constantly change their business strategies. Companies need a new type of agile and responsive organizational structure to fit into the global spectrum of business. With the introduction of Business Process Reengineering (BPR) in 1990s, many organizations redesigned their organizational structure and business processes to achieve dramatic improvement in certain critical measures of performance, such as cost, quality, service, and speed. Most BPR issues focused on using “the power of modern Information Technology (IT) to radically redesign our business processes in order to achieve dramatic improvements in their performance” [1]. Since then, Information Technology (IT) has been recognized as a key catalyst for modern business practices. On the other hand, the need for stronger business partnerships and collaborations have challenged many organization to extend their organizational boundaries and share their visions with others. As a new medium of communication, the Internet has conquered the world with breathtaking speed, and its worldwide penetration and high level

of standardization contributes to increasing globalization. Hence, traditional business partnership schemes have changed, and companies can achieve a business advantage by leveraging networking technology and the principle of supply chain integration. With network connectivity, supply chain integration is now the core strategic competence that enables many companies to act as one. Supply Chain Management (SCM) evolved several decades ago from purely a set of logistics performance tools to an interenterprise, and even channel-wide, operating philosophy. SCM is now a boundary-spanning, channel-unifying, dynamic, and coevolving philosophy of interenterprise management.

The major contribution of today’s supply chain model is to improve the bottom line by enhancing collaboration between businesses and their trading partners [2]. This feature is very important for the construction industry, because many participants (architects, engineers, contractors, subcontractors, material suppliers, equipment providers, inspectors, and owner’s representative) need to cooperate/collaborate intensively throughout a project life cycle, and these will change from one job to another. Although participants may share a common goal of completing a project satisfactorily, their specific objectives are different and their degree

of participation depends on their organizational strategies. Thus, the need for integration of trading partners—especially integration of the supply chain and management functions becomes a strategic vision for the future of construction practices in the e-business era.

Issues related to e-supply chain integration include the internal and external core business processes, the development of close linkages between channel partners, and the management of production and information as they move across organizational boundaries. For example, the manufacturing process for construction materials or the production and distribution of equipment is transparent to all members in the supply chain. The selection of processes and cooperation with supply chain partners are critical to the success of business. The selection of e-supply chain partners extends beyond choosing a trading partner or contractor and must include configuring the business-to-business collaboration among the partners. In the future, the supply chains, rather than enterprises (architect, engineer, construction contractor, manufacturer, and supplier) will compete with each other. An increase in horizontal integration synchronizes the output of the entire supply chain. There will be no isolated islands of automation, and those who can best define and reengineer their business processes in the supply chain partnership are sure to be successful in this industry.

## 2. THE BUSINESS-TO-BUSINESS PARADIGM

Internet technology is presently changing communications to the same degree that PC technology reshaped the computing world twenty years ago. Today, e-business is rapidly expanding into a complex web of commercial activities transacted on a global scale between an ever-increasing number of participants, corporate and individual, known and unknown, on global open networks. Although e-business is sometimes confused with e-commerce, it is now widely accepted that e-commerce is the buying or selling of products, goods, information, and services over the net, whereas e-business is a complex fusion of business processes, enterprise applications, and organizational structure necessary to create a high performance business model [3]. One can say that, without a transition to an e-business foundation, e-commerce cannot be executed effectively. Strictly speaking, no e-business will be truly effective without interacting with all of its supply chain partners in an automated fashion. Therefore, after reengineering and streamlining their own operations, enterprises must

focus on insuring effective communication with their supply chain trading partners.

### *2.1 E-Business Supply Chain Management*

While technology is at the heart of the change that is revolutionizing our economic life, successful e-business is concerned with building new kinds of relationships with suppliers, customers, employees, business partners, investors, regulators, consultants, and all other participants in business life. These relationships are termed the supply chain, and the growing dependence on the supply chain has been accentuated by the following changes to traditional business practices: (a) the growth of information sharing between vendors and customers, (b) the rise of process-focused team efforts replacing traditional departmental functions, (c) the shift in the marketplace from the mass-production of standardized products to flexible operations providing customized products, (d) increased reliance on purchased materials and outside processing with a simultaneous reduction in the number of suppliers, (e) greater emphasis on organizational and process agility, and (f) the rise of employee empowerment management techniques that require the implementation of a rule-based, real-time decision support system.

The development of integrated supply chains is by far one of the most important business trends. The concept of a supply chain is no longer limited to logistics management, but it is a dynamic supply network of interdependent partners that can be quickly reconfigured to satisfy specific needs of a given customer when a new window of opportunity opens in the market or in response to a threat from a competitor [2]. E-business transforms the supply chain into a network that allows companies to work together almost as if they were one company [4] (Figure 1). Specifically, they can move from a serial arrangement, where an order is entered in one end and progresses along the chain, to a collaborative arrangement, where everyone obtains a perspective of the forecasts and tries to be as ready as possible for the outcome. A supply chain is integrated in terms of people focused on processes that ultimately respond to customer demand, but its success requires technology that can integrate and support every exchange of knowledge across the entire supply chain. Modern companies recognize that their competitive edge depends on all links in their supply chain.

### *2.2 Collaboration is the Key to e-Business*

The supply chain involves finance, enterprise resource planning (ERP), inventory management, intercompany engineering change management,

schedule sharing, logistics, transportation, purchasing, replenishment, efficient feedback response, and quality management. However, to be successful the supply chain needs collaboration, to help organizations reduce cost, utilize resources more effectively, and improve relationships with their clients. The fundamental benefit of SCM is cooperation and collaboration among different stakeholders. The objectives and scope of work must be clearly stated and faithfully executed. Cooperation and collaboration are especially critical in the to management of today's supply chain, and they are manifested in the willingness of allied chains of companies to link their strategic objectives and fundamental operational processes to create unique, seamless, market-satisfying resources that are invisible to the customer, but capable of quick massing critical competencies and physical processes to gain competitive advantages.

As mentioned earlier, the purpose of a supply chain is to support collaborative commerce. E-collaboration and e-commerce are two forms of e-business, which encompasses all forms of electronic business activities. All business data are transmitted over a variety of communication networks, and the essence of e-business is the communications of business data between organizations under a collaborative scheme in an entire supply chain. Data communication is critical for streamlining the entire supply chain business processes.

Advances in supply chain applications built on new technology platforms have enhanced the ability of organization to integrate their processes through collaborative information sharing and planning. The sharing of information moves the supply chain closer

to the desired goal of a demand chain. These technology developments include the proliferation of the Internet environment and the introduction of data acquisition technology, such as point-of-sale data collection and analysis. In the e-supply chain, ensuring technology-enabled, real-time information access between customers and suppliers and building closer partnerships with virtual collaboration/coordination are extremely important. E-collaboration partners must align their business processes and information systems to support interenterprise decision-making, with a focus on increasing sales and revenues. All of these features are very important to the construction industry, because many firms need to collaborate intensively throughout a project life cycle and the project team needs continuous access to construction plans as the project proceeds. The next section will illustrate the supply chain scheme for an e-business and show how it can be adopted to the construction industry.

### 3. DESIGNING AN E-BUSINESS SUPPLY CHAIN SOLUTION

An e-business supply chain is a new business model that will drive enterprises to transform their core business processes. This new business model is an integral part of the e-economy, and, to remain profitable, competitive, and efficient, old business processes must be reengineered. To better understand core processes for these reengineering efforts, the value chain concept [5] is an excellent model for identifying an organization's competitive advantage and helping to build a strong supply chain relationship.

#### 3.1 Value Chain Thinking

To design a supply chain solution, one must start with a basic outline of the enterprise's major high-level activities. This will provide a structure for initiating design phase or supply chain management—an example of which is Porter's "generic value chain" (Figure 2). According to the value chain concept, everything that a company does can be categorized into primary and support activities. Porter's value chain consists of five types of primary activities, examples of which are physical production, sale and transfer to the customer, post-sale service, and so forth. Support activities are those which support primary activities and each other by providing purchased input, human resources, and some forms of technology to perform a given function.

Porter's version of supply chain management is called a value chain because it focuses on value, where value is measured by the amount customers are

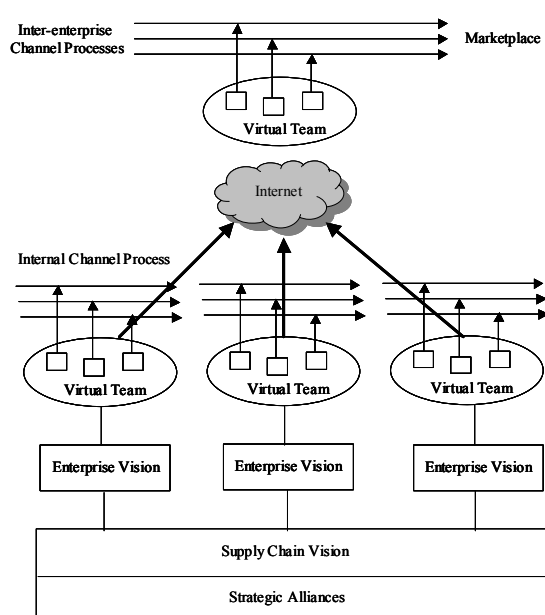


Figure 1. The Virtual Team in a Supply Chain Scheme

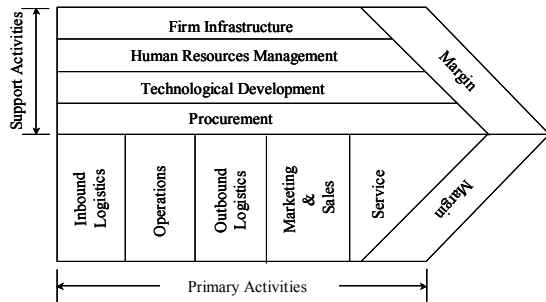


Figure 2. Porter's Value Chain

willing to pay for an enterprise's product or service. Primary and support activities are called value activities, and an enterprise will be profitable as long as it creates more value than the cost of performing its value activities [6]. When developing a value chain, a firm may be separated into its strategically relevant activities to enable a better understanding of existing and potential sources of differentiation, as well as the associated costs. Starting with the resulting generic value chain categories, an organization can further subdivide each into discrete activities, categorizing those activities that best contribute to a firm's competitive advantage. In this way, a value chain is defined and a better organizational structure and business process can then be created around those value activities that can most improve an organization's competitive advantage [7] (Figure 3).

Seeing business processes in terms of a net value added chain is also an "approach for visualizing current and identifying future competitive advantages" [8]. In short, the creation of these values depends on the enterprise's ability to link and coordinate these internal activities efficiently. Porter also recognized linkages outside the enterprise, as they relate to the customer's perception of value.

This provides the possibility that one value chain could be linked to another value chain, because one business partner could be the other's customer. This interconnected value chain system can act like a supply chain that encompass the modern business world, and participating organizations can readily extend their technologies to their partners. The "extended enterprise" aspect enables supply chain integration, more effective outsourcing, and self-service solutions for both internal and external stakeholders [7]. This extended enterprise allows for sophisticated online business processes across trading partners that interweave line-of-business applications with other internal and external information sources. The following section will present an illustration of a true fully integrated e-business solution in the construction industry.

### 3.2 E-business=B2B+SCM+CM

Most construction projects are unique, large, complex, extensive, expensive, and subject to tight schedules and budgets. The construction team for any given project includes some combination of architects, engineers, contractors, subcontractors, materials suppliers, equipment providers, inspectors, and owner's representative, and thus team will normally be different for each project. All of the complexities inherent to different construction sites, such as soil conditions, surface topography, environmental concerns, weather, transportation, material supply, utilities, and local practices, are an innate part of construction. As a consequence, construction projects are characterized by their complexity, risk, and diversity and by the non-standardized nature of their production. Therefore, managing a construction project is an interdisciplinary art requiring extensive professional skills to achieve optimum performance.

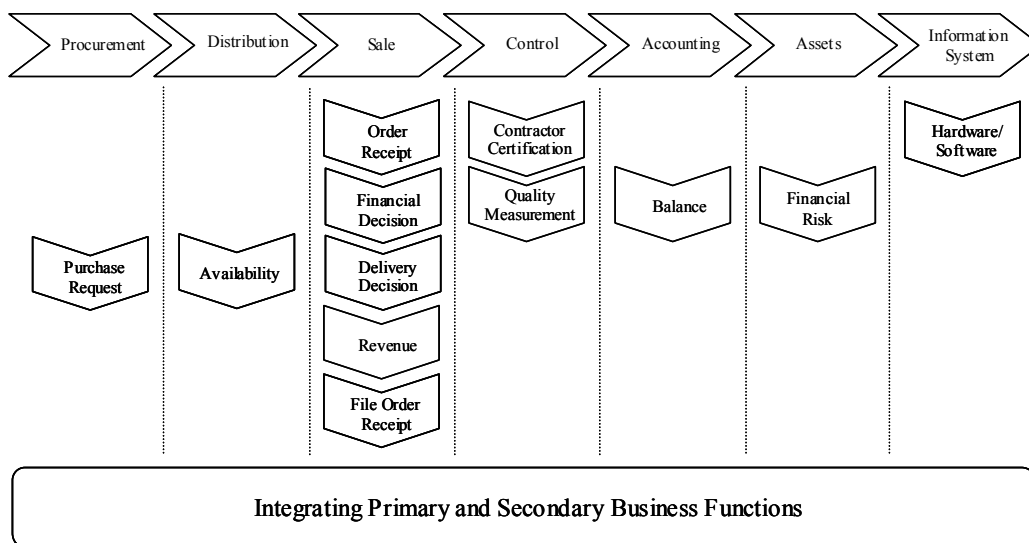


Figure 3. Value Chain Integration

Effective construction management involves many managerial functions, such as scheduling, budgeting, quality control, resource management, and safety issues. The ultimate purpose of these management functions is to allocate resources (manpower, equipment, material, etc.) and then monitor and control them during construction to keep all processes on track during every stage of the project cycle. From the supply chain point of view, project members must collaborate to synchronize the output of the entire supply chain to fulfill a particular job. The project partnership in the supply chain becomes a strategic alliance wherein contractors must align their business processes and information systems to support interenterprise processes and decision-making (Figure 4).

Configuring business-to-business operations among trading partners is very important. Since the supply chain represents the cross-functional integration of all activities that cross the borders of the participating organizations, the issues involved in the selecting of e-supply chain partners extend beyond the choosing a trading partner or a contractor and must include the technological capability to configure the business-to-business collaboration among the partners. As mentioned earlier, using the value chain concept to identify an organization's competitive advantages and then reengineering its core business processes accordingly is the best way to

make a company more process aware, and that is the beginning of interenterprise processes.

It is believed that e-business solutions should be built on an Internet computing architecture that leverages standard Internet Protocols (IPs) and company intranets, extranets, and the global Internet to provide low-cost and universal access to all members of the e-business supply chain. With new web technologies, such as XML, Internet-based systems can deliver functionality and information to users through a standard Web browser, thereby eliminating requirements for traditional Electronic Data Interchange (EDI) or client-based software and reducing Information Technology (IT) implementation and maintenance costs, cycles, and burdens.

The winners in the Internet economy will be those companies that can respond more rapidly and efficiently than the competition to the customer's demand. As a result, an e-business supply chain solution must provide support for the capture and communication of customer demand, as well as enable this demand to automatically trigger business events and initiate process workflow (such as launching manufacturing runs and issuing purchase requests within the enterprise and across the supply chain). A common data model will also be needed for the entire supply chain, because the effectiveness

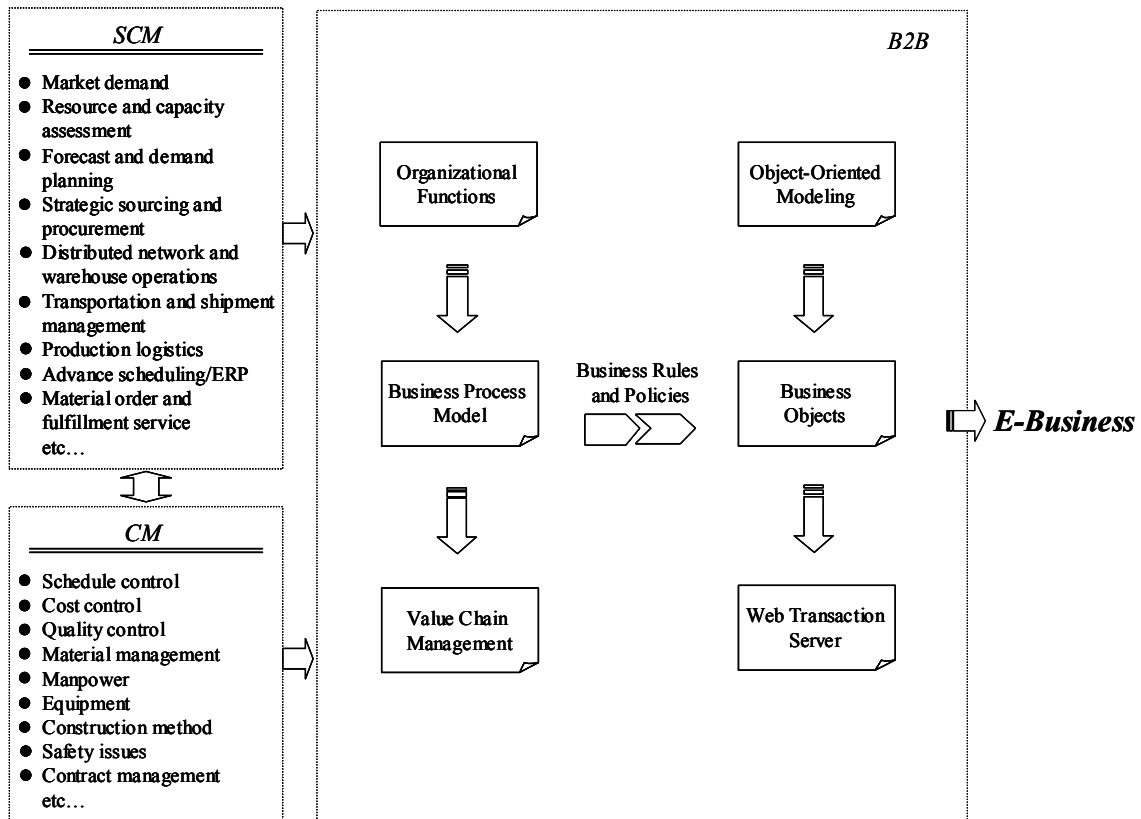


Figure 4. The Supply Chain E-Business Solution

of an e-business supply chain solution will depend largely on its ability to deliver an accurate and common view of customer demand data -- as well as any subsequent events, plans, or other business data. Some features included in the supply chain are (a) information sharing, (b) joint performance measurement systems and collaborative planning processes, (c) exchanges of responsibilities and realignment of work, and (d) redesign of products and processes so that work becomes easier or more efficient [3]. This new "e-supply chain" offers limitless business opportunities at the intersection of processes and technology. A well-designed and well-integrated supply chain will improve upon existing cost-intensive processes, and have organizational agility in the event of change.

#### 4. CONCLUSION

The challenges of the global marketplace are increasingly forcing today's process-centered organization to utilize more fully the knowledge, competencies, and resources to be found in their supply chain networks. Optimizing parallel, rather than serial, processes is the key to supply chain management [2]. The next generation of e-business will be built on an interconnected web of enterprise applications which will help companies connect disparate systems, provide greater access to information, and more closely link employees and customers.

Today's Internet-based supply chain model is designed to improve companies' bottom line by (a) enhancing collaboration between businesses and their customers, suppliers, and trading partners, (b) increasing the speed and flexibility of delivery, and (c) providing self-service capabilities to all parties. The collaboration of people, processes, and technology is important, because companies can enhance customer satisfaction, improve operational efficiencies, and cut costs by leveraging a comprehensive, integrated, e-business suite of applications based on Internet technology. Finally, the explosion of strategic alliances and partnerships on a global scale has enabled the formation of interenterprise "virtual" organizations capable of leveraging the skills, physical resources, and innovative knowledge that reside at different locations in the supply network. This approach allows construction business processes to permeate different organizations, and these organizations will extend their technologies to outside stakeholders. Communication in this supply chain becomes process-to-process oriented, and collaboration is the best way that trading partners interact.

Process integration across the supply chain thus becomes a new challenge for the construction industry. Construction firms will need to learn that content communication is as important as technological infrastructure to the enterprise software application architecture. With a new focus on process and supply chain management, traditional construction industry partnerships will have to redesign their business strategies. The Collaborative Commerce supply chain scheme that enables a dynamic "virtual construction team" to fulfill many mission-critical business processes throughout a project life cycle will undoubtedly be the best business solution for the new millennium.

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