

The Framework of Enterprise Information Processing Network for Knowledge Discovery and Sharing

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Abstract

The challenges of the global marketplace are increasingly forcing today's process-centered organizations to utilize the knowledge, capabilities, and resources to be found within their information processing networks. The issue of whether or not companies should exploit their intangible knowledge assets is far more critical than their ability to invest and manage their existing physical assets. Under this paradigm shift, information-oriented productivity depends on the sharing of knowledge and skills among workers, so that enterprise strategies can be driven by the collective intelligence and competence of the group to face today's business challenges and enable organizational learning. Management of organizational knowledge to create business values and competitive advantages is critical towards the organizational development. This paper focuses on the transformation of an enterprise information-processing network into a knowledge network for supply chain co-evolution. The ultimate goal is to develop a technological framework for a knowledge network that brings people, information, technologies, business processes, and organizational strategies together to better utilize knowledge in e-business. A knowledge network is introduced to enhance collaboration, encourage innovation, boost productivity, achieve adaptivity, and increase the information system efficiency. In tomorrow's enterprises, knowledge will be the key to release creative energies that will inspire enormous innovations and great discoveries!

1. The Emerging Business Intelligence

Over the past few decades, organizations have constantly "reinvented" themselves through a series of business and technological innovations to fit into the global spectrum of business. Manual workers and mass production schemes are not a predominant factor to today's new business. Functional integration to streamline the flow of business operations is no longer as popular as emerging process-oriented business practices. Information, such as demographics, consumers' behaviors, and numerous other business statistics, and the associated processing power are critical for the survival of organizations in business. With the global deployment of computers, uniform information architecture, and interconnecting networks, participants can work collaboratively, share networked resources, exchange

knowledge, and improve corporate or supply chain performance. Accordingly, corporate and supply chain strategies can be driven by the collective intelligence of groups to better meet today's business challenges. The increasing adaptivity of business practices has led to the role of Business Intelligence (BI) in knowledge management. BI relies heavily on the interpretation of data into useful knowledge for their trading partners within and across the supply chain to gain a competitive advantage. This same business strategy is becoming increasingly adapted by every industry, where successful ventures with a long-term competitive advantage will be characterized by their ability to create new knowledge, quickly disseminate and incorporate it into their production processes, products, and services. As we move this new millennium there will be a fundamental shifts in the prevailing paradigms and knowledge-oriented productivity will present the greatest challenge to management.

2. Knowledge Workers and Empowerment

The traditional managerial hierarchy is not addressed in the horizontal nature of collaborative or team-based communications, because of its vertical emphasis on communications and information systems. The shift from a division/functional organization to a matrix, and then to a network form arose from a desire to create organizations that utilize knowledge across processes and functions. Especially, the rapid growth of the Internet brought about a reevaluation of the old supply chain philosophy and fostered the growth of new strategic alliance and business process integration across the border of organizations, thereby enabling organizations to more fully utilize the skills, knowledge, competences, and resources found in their supply chain network. The enterprises will be able to better work together on a project across departmental and organizational barriers. Under this paradigm shift, intelligence and control are no longer concentrated in division offices. Empowered workers are actively engaged in their jobs, and they have the authority to form autonomous teams with self-defined roles and structures. The project members to form a "virtual team" can be from different divisions, departments, or even organizations. Those empowering workers will lead to radically different organizations that can cope with the ever-changing business environment. Interdependency between core knowledge workers will increase as the success of the enterprise becomes more

dependent on how well they integrate their knowledge to produce innovative products and services [1]. This is the key issue of today's knowledge-enabled organization, and many of the concepts are brought into discussions of this paper. The objective is to develop a knowledge management framework that brings people, information technologies, business process, and organizational strategy together to better utilize knowledge in business practices in a supply chain scheme. There are several factors needed to consider in order to develop a successful KM system. The first is to recognize the organization's competence.

2.1 Organizational Competence

Whenever a technological innovation is introduced, it brings both new business opportunities and new challenges to organizations. The introduction of Business Process Reengineering (BPR) in the 1990s stressed the importance of Information Technology to business practices. Most BPR issues focused on using "the power of modern Information Technology to radically redesign our business processes in order to achieve dramatic improvements in their performance" [2]. Since then, many organizations recognized IT as a key catalyst for modern business practices, and redesigned their organizational structure and business processes to improve certain critical measures of performance, such as cost, quality, service, and speed. Though IT helps an organization gain a competitive advantages, business strategies should also focus on what "value" might be created for the organization in the marketplace. BPR uses

IT to radically redesign core business processes in response to key competitive factors.

These competitive factors can be derived from the Porter's value chain [3] concept which divides an organization into a set of generic functional areas (Figure 1). 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: Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service. Support activities 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 that customers are 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 [4]. 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 [5]. Technological innovations usually give companies new ideas for their organizational structure and management. This value chain thinking allows organizations to identify their competitive strengths and weaknesses and therefore

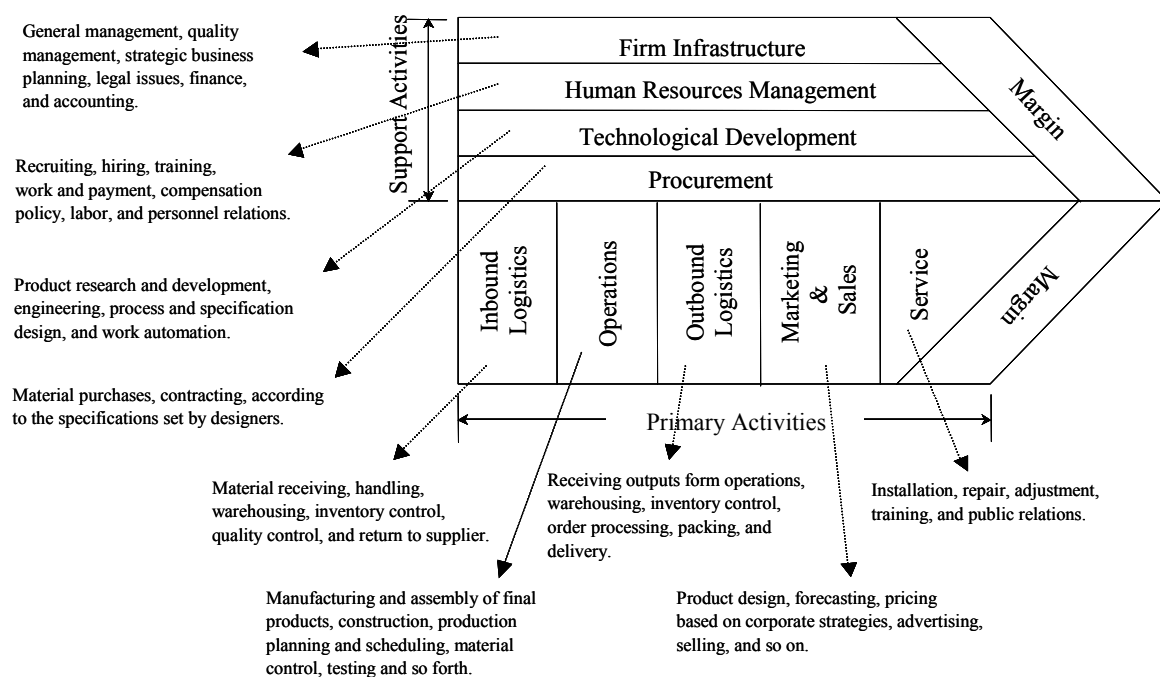


Figure 1 Porter's Value Chain and Value Activities

to reengineer their enterprise performance. All these “value-finding” processes are crucial to the development of a successful KM system. A KM system that fully utilizes an organization or an entire supply chain’s strength to take every business opportunity.

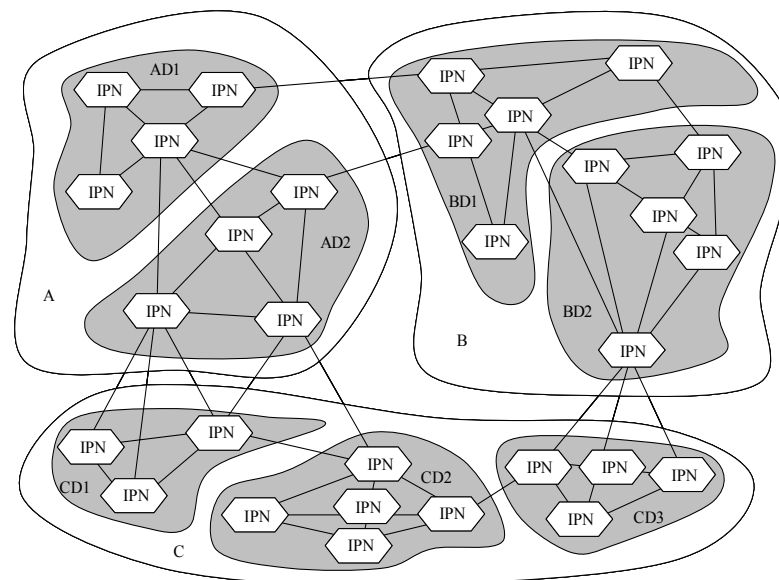
One factor worth mentioning is that value also includes all information that flows through an organization and between an organization and its suppliers, its distributors, and its existing or potential customers. Indeed, information defines business relationships. Having a relationship means that two or more companies have established certain channels of communication based on personal acquaintance, mutual understanding, shared system standards, or synchronized production results. These imply the need for stronger business partnerships, and collaborations have challenged many organizations to extend their organizational boundaries and share their visions with others.

3. The Information Processing Network and Value Chain

The information processing view of an organization has been considered one of the most influential contributions to the contingency literature [6]. In this philosophy, information processing network provides the channels for exchange and processing of information in a global system. The primary system objective of the information processing network is to provide a

communication backbone for information exchange among its subsystem, the information processing nodes. The information-processing nodes within the network are responsible for receiving, using, selecting, producing, sending, and communicating (i.e. exchange information) with other information processing nodes. As a result, the lattice of channels between the various information-processing nodes forms a physical communication infrastructure called an information-processing network.

The characteristics of information-processing nodes are much like the business components, but they conduct the actual exchange of information. The business components of the organization include people, processes, events, machines, and information that interact and combine to produce the products or output of the organization. People and information-processing machines, such as computers, are in this category. An enterprise operates as an information-processing system in a global information-processing network. Because it is an open structure, the network can be developed in a fractal pattern. The information-processing network can be expanded and connected to other organizations’ information-processing networks (Figure 2). The information-processing nodes within each network in either organization can work collaboratively to achieve strategic goals in the newly joined network. To this point, we concluded 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



Business components can exist autonomously within an organization, or being shared by trading partners in a global network in an strategic alliance scheme.

Note: Organization A, B, C...
Department A1, A2...B1, B2...C1, C2...
IPN Information Process Node

Figure 2 The Information Processing Networks

system can act like a supply chain that encompass the modern business world, and participating organizations can readily extend their technologies to their partners.

4. E-Business Supply Chain Knowledge Management

Traditional business partnerships are changing in response to technology advancements and business innovations. 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 a simple set of logistics performance tools to an inter-enterprise, and even channel-wide, operating philosophy. SCM is now a boundary-spanning, channel-unifying, dynamic, and coevolving philosophy of inter-enterprise 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 [7]. This feature is very important for the every industry, because many participants (contractors, subcontractors, material suppliers, equipment providers, and supervisors) need to cooperate/collaborate intensively throughout a project life cycle, which will change from one job to another.

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 raw materials or the production and distribution of equipment is transparent to all members in the supply chain. The selection of processes and cooperations with supply chain partners is 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 the enterprises (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 more successful in this industry. In today's e-business, competing for knowledge requires either aligning one's strategy to what the organization knows or developing knowledge management (KM) capabilities to support a desired supply chain strategy. The ability of companies to exploit their intangible assets has become far more important than their ability to invest and manage their physical assets. Knowledge requires sharing and corporate strategy can be driven by knowledge. Knowledge management systems must to address the

strategic visions of organization. Knowledge management systems should support people to access and learn from past and present organizational business practices/strategies and to apply the lessons learned when making future decisions. Based on the above discussion, a successful knowledge-oriented business for organizations should link supply chain management, relationship management, and knowledge management to function in an adaptive way and continue to thrive in the e-business era.

5 The KM System Architecture

5.1 Knowledge Utilization

An e-business supply chain knowledge management is a new business philosophy that drives enterprises to transform their business intelligence. Organizations are becoming knowledge intensive instead of capital intensive. This new business philosophy is an integral part of the knowledge economy for today's organizations and supply chains to remain profitable, competitive, efficient, adaptive, and more intelligent. Organizations that will truly flourish can utilize IT to leverage personnel knowledge in ways that are immediately available. The design of a KM system needs to focus on the issues of data acquisition, information access/retrieval for knowledge utilization, communication, knowledge sharing, business process/information integration, document management, and most of all—collaboration. The focus on collaboration and collaborative support is perhaps one of the major distinguishing factors that differentiates knowledge support systems from other information systems. In business practices, collaborative problem solving, conversations, and teamwork generate a significant proportion of the knowledge assets that exist within a firm or entire supply chain. With network connectivity, the virtual teams can work collaboratively to share knowledge and best practices that enable supply chain “co-evolving.” In this “knowledge network,” a dedicated knowledge server and a database are required, because knowledge management must capture and retain in a central/distributed data repository the data and information that employees need. The technologies to facilitate these highly interactive communications are summarized in Figure 3. In this figure, Internet/Intranet and groupware system are the most important ones for group communications and knowledge-sharing. For knowledge sharing, the architecture of IT in the knowledge management system is concerned with organizing and analyzing information in an organization's database so this knowledge can be readily available throughout a company. To help companies organize information residing in multiple locations and deliver it to prospective users, combinations of directory service, indexing, and searching are required in the KM system. Available groupware and document management systems do an excellent job in satisfying this requirement.

Document management is a part of supporting IT, and it includes the ability to automatically develop and

classify document databases. In business practice, the project teams work collaboratively on the creation of documents and insuring that everyone has access to the latest updated version of the documents, which avoids working on the inconsistent versions of these documents. The groupware is an integrated collaborative tool that supports not only several people working together on a task, but also their different and potentially changing roles. It has email and messaging functions, document management and information sharing, collaborative authoring, conferencing, time management, and some level of structured workflow support. Its database management ability organizes, stores, replicates, and provides shared access to documents by using a hypertext scheme. It has all the functionalities to support basic business practices and knowledge management. Many groupware systems also allow the documents to be posted on the Intranet or the Internet. One of the most dominant groupware systems is Lotus Notes (now incorporated as IBM) which allows groups of users to interact and share information in an organized fashion.

With the growing maturity of Internet technology, the web can become more active. Applications can run on clients' browsers. The technological breakthrough makes the development of future web-based groupware systems (utilizing corporate Intranet) easier, because the traditional groupware and the web-based groupware have some similarities in terms of communications and

collaborations. The groupware and Internet's hypertext scheme can easily profile different categories of business information (such as from specifications and manuals to make hypertext specifications or a TQM manual) for people working on the job site, or provide them with a "hyper-trail" for step-by-step operations. Behind the scene is a complex web that links different databases residing in the project team's organizations. With the aid of hypertext, an organization's information system becomes more accessible and adaptive, and the project data can be easily stored in archives for historical reference. One of the differences between the Internet and groupware is its platform-independent advantage that makes it possible to deliver business data and streamline business processes across heterogeneous business partners in the flash of a second.

As mentioned before, a central/distributed data repository that provides/captures the data and information for employees and executive decision-making is very important in a knowledge management system. The database is the core of a KM system, the decision-making support system is the driver that consolidates and directs the overall resources of the supply chain to the most mission-critical business activities to generate profits. It is believed that the next generation of knowledge management systems will be built on the Internet backbone with "agents" that flow through the net to gather business information and display it for decision-

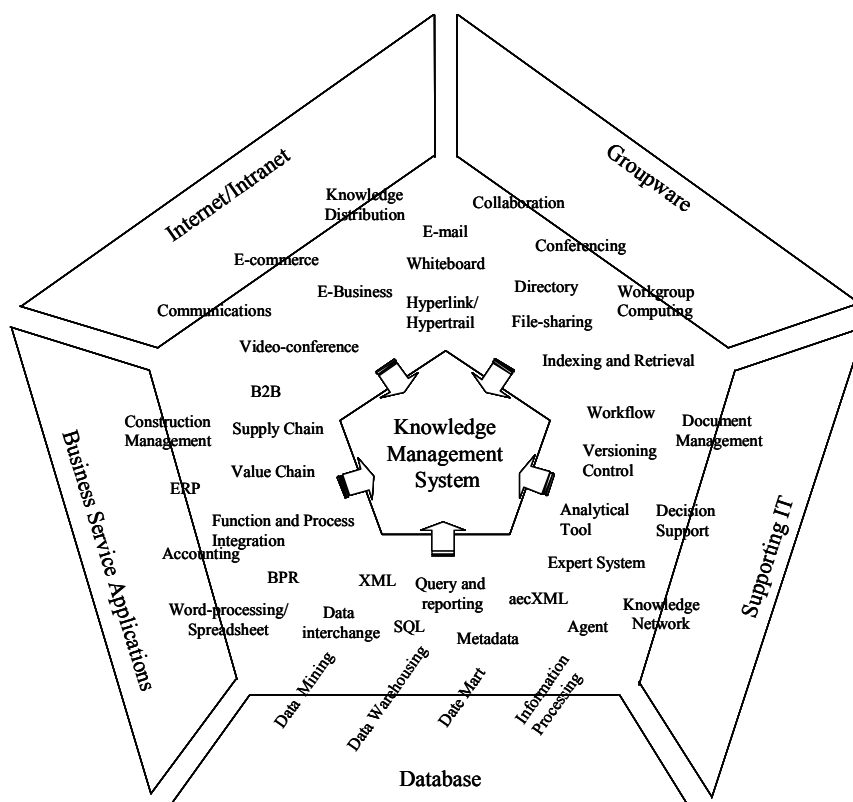


Figure 3 Knowledge Management Technological Framework

making purposes.

On the other hand, the basic business applications are necessary to conduct daily business, such as word-processing, spreadsheets, accounting, and so forth. In addition, with the growth of the Internet, e-business is rapidly expanding into a complex web of commercial activities. Many organizations have recognized this competitive advantage and have shifted their focuses from process improvement within an organization to process integration across their trading partners. This business-to-business practice transforms the traditional supply chain into a network that allows companies to work together almost as if they were one company. The key issue is the inter-enterprise processing. Therefore, knowledge management also includes business processes integration.

5.2 The Learning Organization and Smart Supply Chain

Senge in his thoughtful and provocative book [8] on system thinking described a “Learning Organization” as “an organization that is continually expanding its capacity to create its future.” A knowledge-enabled organization is a learning organization, one where all employees are using their knowledge, skills, and learning to meet today’s business challenges and to create new opportunities for the future. One thing important is that the organization also learns from customers, suppliers, and even competitors: from any and every relevant source within or outside the organization. This extended learning capability leads to a new definition of supply chain

management and customer relationship management (CRM).

In today’s e-business, companies can achieve a business advantage by leveraging networking technology and the principle of supply chain integration to improve the bottom line by enhancing collaboration between their business and trading partners. The beauty of a supply chain knowledge network is that the true value of the information surpasses the conventional boundaries that often restrict employees’ thinking [9]. 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 (Figure 4). A KM infrastructure combines automation, business rules, artificial intelligence, workflow, analytical tools and advanced messaging-analysis technologies to allow e-businesses to deliver information and to respond to customer requests rapidly and accurately [10]. Therefore, in a successful k-business model, the sharing of information moves the supply chain closer to the desired goal of a demand chain. In this way, a true knowledge management system can be built and utilized by the entire supply chain community to generate profits.

6. Conclusion

Changing technology is the driving force behind the next wave of economic growth. To take advantage of this growth, organizations will have to apply both new

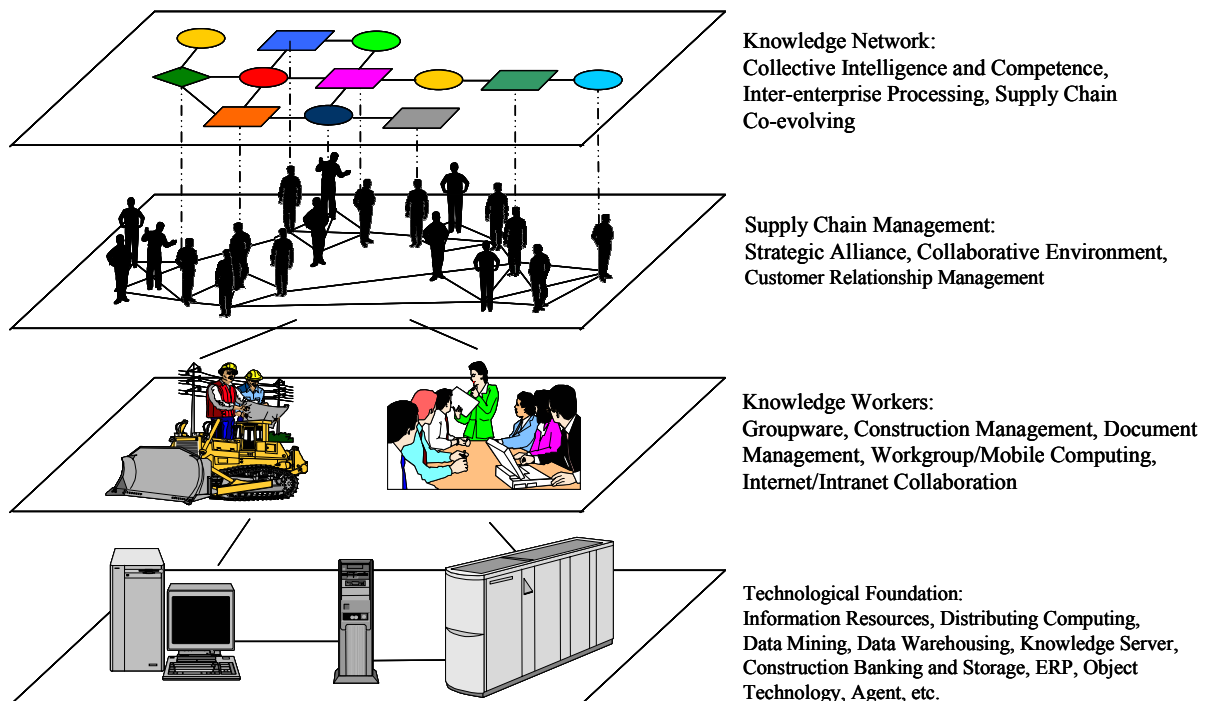


Figure 4 The Knowledge-enabled Supply Chain

technology and new thinking. First and foremost will be the ability to understand the paradigm shift in the economy from data to information and from information to knowledge. Data is the basic building block of information and ultimately of a knowledge-based business. In business practices, information is the glue that unifies businesses partnerships. Many organizations use their information processing networks and strive to become knowledge-enabled organizations to ensure that all employees are able to locate, access, and utilize the knowledge and skills they need to meet their individual and corporate goals. An organization's value chain consists of all activities performed to design, produce, market, deliver, and support its product and service. Knowledge Management is introduced to enhance collaboration encourage innovation, boost productivity, achieve adaptivity, and increase the information system efficiency. On the other hand, the challenges of the global marketplace are increasingly forcing today's process-centered organizations 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. The next generation of e-business will be built on an interconnected network which will help companies connect disparate systems, provide greater access to information, and more closely link employees and customers.

As a result, a successful knowledge management system for today's new business must provide support for the capture and communication of customer demands, as well as enable these demands to automatically trigger business events and initiate process workflows (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 knowledge network, because the effectiveness 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. This new "e-supply chain" offers unlimited business opportunities when enterprises fully integrated their knowledge, processes, and technology. A well-designed and well-integrated supply chain will improve existing cost-intensive processes and provide organizational agility in the event of change.

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