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E-Business and Supply Chain Collaboration

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E-business - the use of Internet-based computing and communications to execute both front-end and back-end business processes - has emerged as a key enabler to drive supply chain integration. Businesses can use the Internet to gain global visibility across their extended network of trading partners and help them respond quickly to a range of variables, from customer demand to resource shortages.

This Paper examines the impact of e-business on supply chain integration, with particular emphasis on four key areas: *information sharing, synchronized planning, workflow coordination,* and the evolution of *new business models*. It offers real-world examples of how companies large and small have adopted e-business approaches to achieve the significant benefits of supply chain integration. It illustrates the power of e-business with examples of innovative technology solutions. Finally, it discusses how cross-supply chain performance monitoring will be a critical success factor in achieving the advantages inherent in supply chain integration.

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I. Introduction

Over the past decade a combination of economic, technology and market forces has compelled companies to examine and reinvent their supply chain strategies. Some of these forces include the globalization of businesses, the proliferation of product variety, increasing complexity of supply networks, and the shortening of the product life cycles. To stay competitive, enlightened companies have strived to achieve greater coordination and collaboration among supply chain partners in an approach called "supply chain integration."

Information technology, and in particular, the Internet, play a key role in furthering the goals of supply chain integration. While the most visible manifestation of the Internet has been in the emergence of electronic commerce as a new retail channel, it is likely that the Internet will have an even more profound impact on business-to-business interaction, especially in the area of supply chain integration. The Internet can redefine how back-end operations — product design and development, procurement, production, inventory, distribution, after-sales service support, and even marketing — are conducted, and in the process alter the roles and relationships of various parties, fostering new supply networks, services and business models. The term "e-business"— as distinct from "e-commerce" — can be used to describe this exciting adoption of the Internet to accelerate the goal of supply chain integration. In this context, e-business specifically refers to "*the planning and execution of the frontend and back-end operations in a supply chain using the Internet.*"

In fact, e-business has already had a significant impact on supply chain integration, but it is safe to say that we have only scratched the surface. New models are continuously being developed. By adopting e-business approaches for supply chain integration, companies can realize dramatic returns through efficiency improvements, better asset utilization, faster time to market, reduction in total order fulfilment times, enhanced customer service and responsiveness, penetrating new markets, higher return on assets, and ultimately, higher shareholder value.

II. Supply Chain Collaboration and E- Business

Virtual integration is to use technology and information to blur the traditional boundaries among suppliers, manufacturers, distributors, and end users in a supply chain. Today, the virtual corporation of various firms in a supply chain is a reality with suppliers and customer trading over the Internet in real-time to create maximum value. Virtual integration offers the advantage of tightly coordinated supply chain that has traditionally come through vertical integration. In the age of virtual organizations, managers, engineers, professional staff, and technical workers are no longer the lone custodians of the corporate knowledge base. Knowledge is shared across cultural-boundaries, time-boundaries, and space-boundaries to create strategic frontiers in global and virtual enterprises.

A seamless virtual integration of firms within a supply chain requires real-time automation of inter-organization business processes that span across trading partners. In the last decade, organizations involved in a supply chain use e-mail, faxes, and voice mail. These practices introduce delays and often require data to be re-entered multiple times. In 1997, American companies spent $862 billion, or approximately 10 percent of GNP, on supply related activities. This includes the movement of materials, storage, and control of products across the supply chain. During the late 90s of last century, productivity surged from 1.5% in earlier years to 2.5%. The increase in productivity in the late 90s is a direct result of computer technology.

The traditional arm's length transaction from one stage of supply chain to the next is illustrated in Figure 1.1(a). Organizations view their suppliers and

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customers as adversaries who are not to be trusted. This prevents entry into successful long-term relationships. Performance is often narrowly viewed and procurement decisions are often based solely on price. Relationships are viewed in terms of a zero-sum game where there is a clear winner and a clear loser.

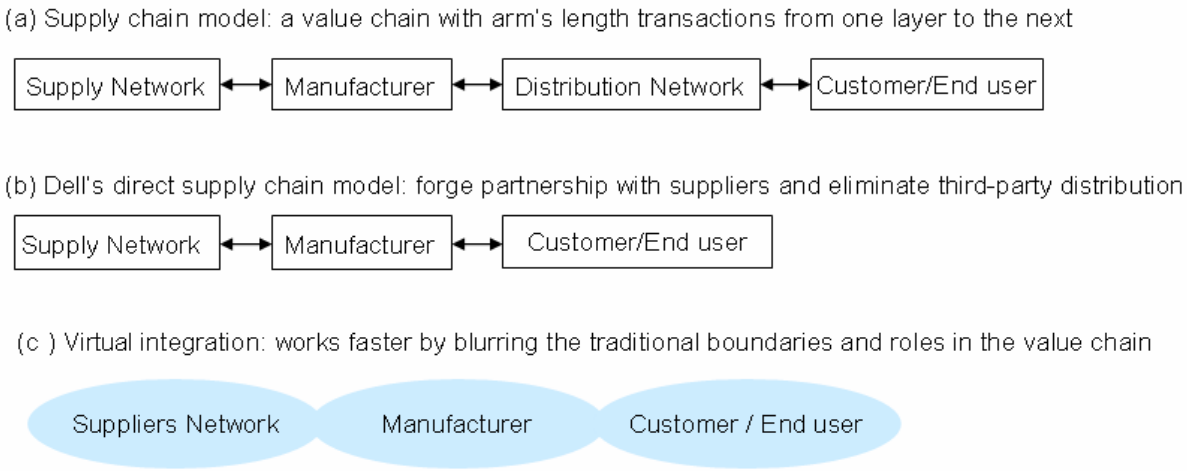

Figure 1.1 : Supply chain in e-Biz environment

The integrated supply chain model that Dell Inc. creates is illustrated in Figure 1.1 (b). This model focuses on mutual trust and respect of supply chain members, just-in-time manufacturing, and eliminating third-party retailers. With this integrated supply chain, Dell only holds five days of inventory, and has a build cycle of two days on most systems. The integrated supply chain includes joint improvement projects, training seminars, workshops, and meetings between organizations' top management. As the degree of communication increases between customers and suppliers, higher levels of informal information sharing are witnessed.

A step ahead of integrated supply chain is virtual integration, which blurs the walls of supply chain organizations as illustrated in Figure 1.1(c). The trend of mass-customization forces many companies to focus on their core competences, and outsource a wide range of functions including design, manufacturing, and distribution. This trend drives the need for a virtually integrated supply chain.

Table 1 : Supply Chain Integration Dimensions

Dimensions	Elements	Benefits
Information Integration	□ Information sharing & transparency □ Direct & real-time accessibility	□ Reduced bullwhip effect □ Early problem detection □ Faster response □ Trust building
Synchronised planning	□ Collaborative planning, forecasting & replenishment □ Joint design	□ Reduced bullwhip effect □ Lower cost □ Optimized capacity utilization □ Improved service
Workflow Coordination	□ Coordinated production planning & operations, procurement, order processing, engineering change & design □ Integrated, automated business processes	□Efficiency & accuracy gains □ Fast response □ Improved service □ Earlier time to market □ Expanded network
New Business Models	□ Virtual resources □ Logistics restructuring □ Mass customization □ New services □ Click-and-mortar models	□ Virtual resources □ Logistics restructuring □ Mass customization □ New services □ Click-and-mortar models

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There are four key dimensions in which the impacts can be found:

- Information integration
- Planning synchronization
- Workflow coordination, and
- New business models

Taken in order, these four represent escalating degrees of integration and coordination among supply chain members, culminating in whole new ways of conducting business.

a) Information Integration

Information integration refers to the sharing of information among members of the supply chain. This includes any type of data that could influence the actions and performance of other members of the supply chain. Some examples include: demand data, inventory status, capacity plans, production schedules, promotion plans, and shipment schedules. Ideally, such information can be accessible by the appropriate parties on a real-time, on-line basis without significant effort.

b) Planning Synchronization

Planning synchronization refers to the joint design and execution of plans for product introduction, forecasting and replenishment.

In essence, planning synchronization defines *what* is to be done with the information that is shared; it is the mutual agreement among members as to specific actions based on that information.

Hence, members in a supply chain may have their order fulfilment plans coordinated so that all replenishments are made to meet the same objective – the ultimate customer demands.

c) Workflow Coordination

Workflow coordination refers to streamlined and automated workflow activities between supply chain partners. Here, we take integration one step further by defining not just "what" we would do with shared information, but "how." For example, procurement activities from a manufacturer to a supplier can be tightly coupled so that efficiencies in terms of accuracy, time, and cost, can be achieved. Product development activities involving multiple companies can also be integrated to achieve similar efficiencies. In the best-case situation, supply chain partners would rely on technology solutions to actually automate many or all of the internal and cross-company workflow steps.

d) New Business Models

Adopting e-business approaches to supply chain integration promises more than just incremental improvements in efficiency.

Many companies are discovering whole new approaches to conducting business, and even new business opportunities not previously possible. E-business allows partners redefine logistics flows so that the roles and responsibilities of members may change to improve overall supply chain efficiency. A supply chain network may jointly create new products, pursue mass customization, and penetrate new markets and customer segments. New rules of the supply chain game can emerge as a result of integration fuelled by the Internet.

e) Integration = Cooperation

Integration cannot be complete without a tight linkage of the organizational relationships between companies. This linkage must take place on many planes.

- *Channels of communication* must be well defined and maintained, with roles and responsibilities clearly articulated.
- *Performance measures* for members of the supply chain also need to be specified and monitored. A member of the supply chain may be held accountable for some performance measures of another member, and there may be some performance measures for which multiple organizations are jointly held accountable. Such extended performance measures encourage closer collaboration and coordination.
- *Incentives must be aligned for* all members in order for supply chain integration to work. Incentive alignment requires a careful definition of mechanisms in which the risks and associated gains of integration efforts are equitably shared. Moreover, the incentive for each member must commensurate with her investment and risk.

The success of any supply chain integration effort is predicated on close cooperation inspired by a perception of mutual benefit. As we will see, e-business approaches can go a long way toward fostering the necessary level of trust and commitment.

f) The Role of technology and the internet

Supply chain integration is not new; many companies have already pursued it as a way to gain competitiveness. Information technology has long been a major factor. Relational databases, client/server architecture, TCP/IP network protocols, multimedia, wireless technology, and most recently, the Internet, have each, in their way, spurred new innovation and new possibilities.

The e-business, or Internet computing, model, has now emerged as perhaps the most compelling enabler for supply chain integration. Because it is open, standards-based and virtually ubiquitous, businesses can use the Internet to gain global visibility across their extended network of trading partners and help them respond quickly to changing business conditions such as customer demand and resource availability.

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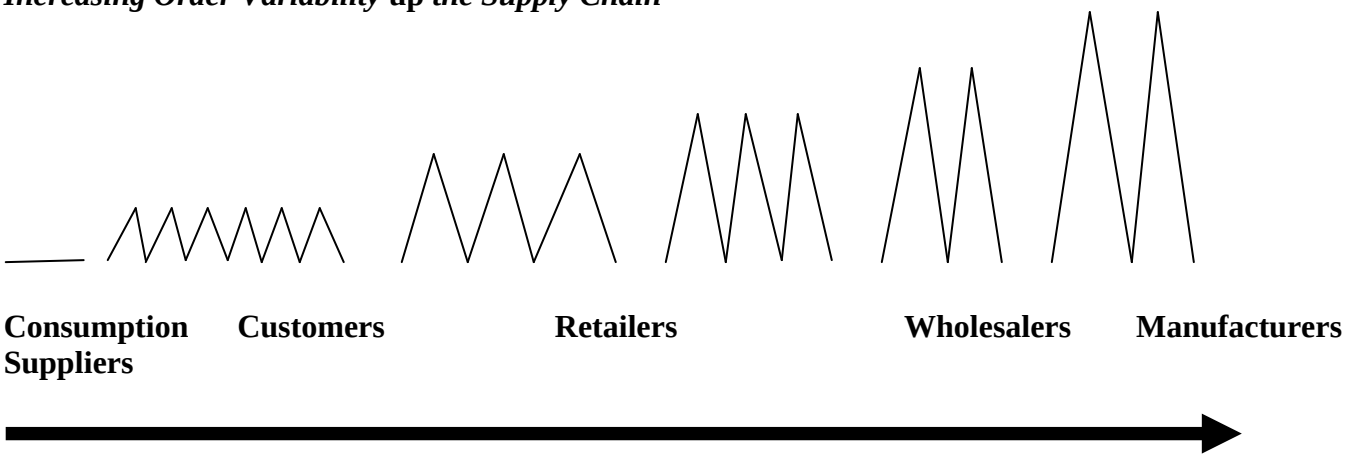
III. Electronic Information Integration

Information integration is the foundation of supply chain integration. For companies across a supply chain to coordinate their product, financial and information flows, they must have access to accurate and timely information reflecting the status of their supply chain. The capability for all supply chain partners to have access to share information on a timely basis is therefore a key to improving supply chain performance.

To ensure that a supply chain is driven by true consumer demands, information sharing is critical. This is the most effective way to counter the problem of demand information distortion in a supply chain -- the well known "bullwhip effect." Information distortion often arises when partners make use of local information to make demand forecasts and pass them to upstream partners; partners making ordering decisions based on local economic factors, local constraints or performance measures; and gaming behaviours to exaggerate orders when there are perceived uncertainties in supply conditions. These distortions are amplified from one level to another in a supply chain, and are considered to be one of the biggest causes of inefficiencies in a supply chain.

Figure 1 : Information Distortion and the Bullwhip Effect



One way to counter the bullwhip effect is to have transparency of demand information. Indeed, in the grocery industry, such transparency is considered to be the cornerstone of supply chain integration, and is a key ingredient of "Efficient Consumer Response," a movement towards total supply chain integration in that industry. Companies engaged in information sharing efforts usually share sales data, inventory status, production schedule, promotion plans, demand forecasts, and shipment schedule information.

a) Internet Info hubs: key to sharing

The Internet is an efficient electronic link between different entities, and has proven to be an ideal platform for information sharing. The power of the Internet stems from open standards, permitting easy, universal, yet secure, access to a wide audience at a low cost.

One approach to Internet-based supply chain integration is the *information hub* that instantly processes and forwards all relevant information to all appropriate parties. The information hub is a node in the data network where multiple organizations interact in pursuit of supply chain integration. It has the capabilities of data storage, information processing, and push/pull publishing. The overall network forms a hub-and-spoke system with the participants' internal information systems (i.e., ERP or other enterprise systems) being the spokes.

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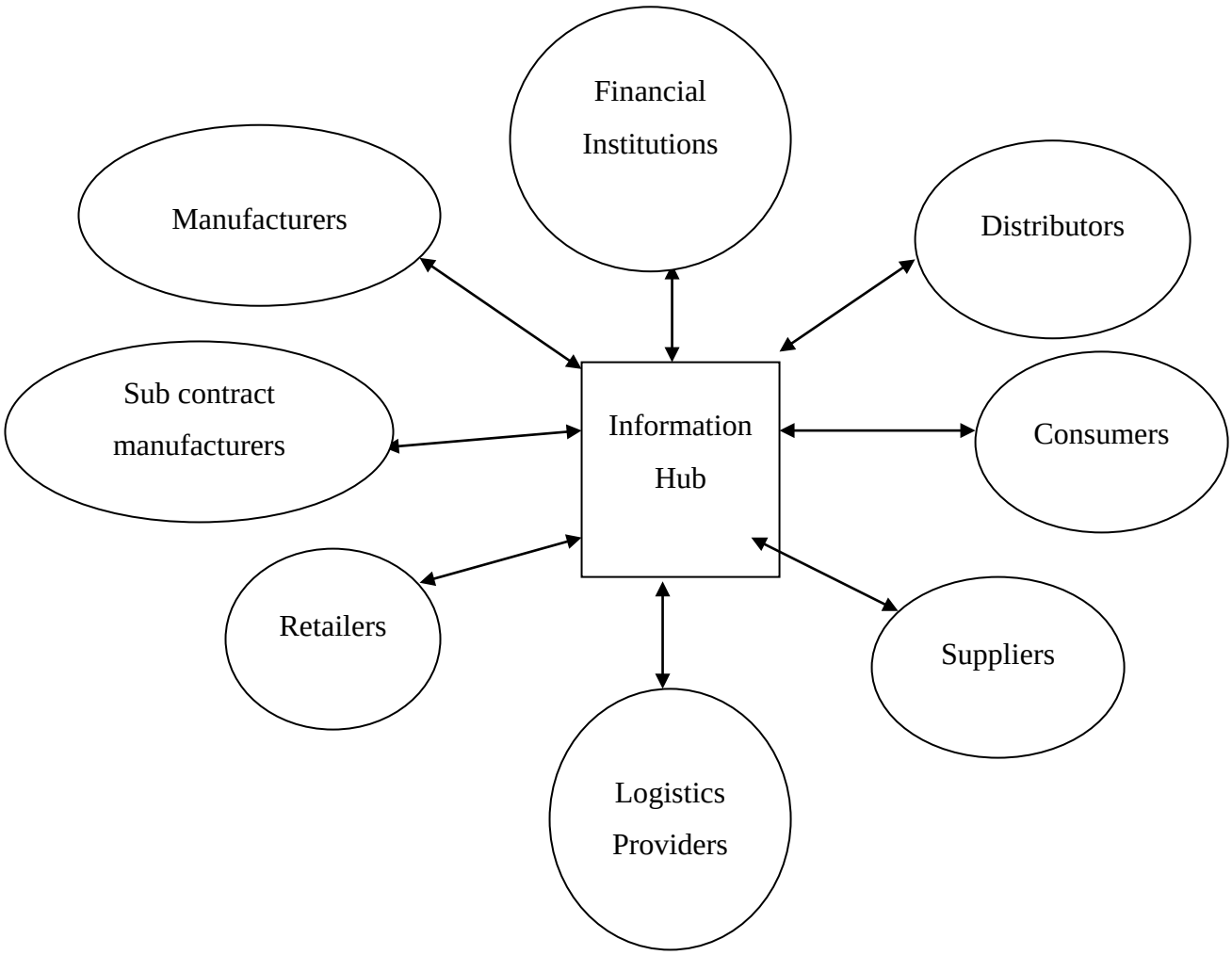
Figure 2 : The Information Hub Model



An analogue to the information hub in the physical logistics world is "cross-docking," a process in which products from multiple supply sources arriving at a logistics hub are sorted in accordance to the needs of destination points. They are then delivered to the destination points without being stored at the hub. In a similar fashion, the information hub allows critical supply and demand data to be "cross-docked" and seamlessly forwarded to the right partners at the right time.

b) Collaboration = Profits

Is information sharing worth the effort and risk? A recent study conducted jointly by Stanford University and Accenture (formerly Andersen Consulting), looked at 100 manufacturers and 100 retailers in the food and consumer products industry. The results were revealing: companies that reported higher than average profits were the ones who were engaged in higher levels of information sharing.

IV. Planning Synchronization

Once supply chain members agree to share information, the next logical step is to agree on what to do with it. Planning synchronization points to the exchange of *knowledge* by the partners so that they can collaborate to create synchronized replenishment plans. Establishing ground rules on what to do with shared information and agreeing on critical actions up and down the supply chain can further mitigate problems such as the bullwhip effect. It also goes a long way toward ensuring that all partners achieve full value from the integration exercise.

Here, again, the Internet can play a key role. One such example is the Collaborative Planning, Forecasting and Replenishment (CPFR) initiative. In CPFR, both the buyer and the seller make use of the Internet to share forecasts, detect major variances, exchange ideas and collaborate to reconcile differences, so that eventually, both have a common forecast and replenishment plan.

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Currently, the Voluntary Industry Commerce Standards Committee is working on formalizing the process models and technology framework for CPFR. It encourages companies to utilize the Internet, with electronic bulletin boards, to pursue the collaborative efforts.

a) From Nuts to 'Nets the internet delivers

Both consumer and business-to-business companies can achieve the benefits of Internet-driven collaboration. Snack giant Nabisco successfully conducted a promising CPFR pilot with grocery chain Wegmans. Due to smart promotions, Wegmans had seen an 11% growth of snack nut sales versus a 9% decline at other retailers. By strategically sharing demand data and collaborating closely on promotions and replenishment, Nabisco saw its Planters sales jumped 40%, dramatically increasing its market share at Wegmans. Moreover, Nabisco's warehouse fill rate increased from 93% to 97%, while inventory dropped by 18%.

Several other pilots are now under way at Schnuck Markets, Kmart, Circuit City, P&G, Kimberly Clark, Sara Lee and Wal-Mart.

In the business-to-business world, Adaptec, a fab-less semiconductor company, and Cisco Systems, the leading networking equipment vendor, are undertaking similar initiatives.

The case of Adaptec illustrates the value of internet-based collaboration to a company faced with evolving supply processes, innovative products, and a geographically dispersed supply chain.

Using a software application called Alliance (developed by Extricity, now part of Peregrine); the company communicates in real time with its design centre in California, its foundry in Taiwan, and assembly plants in Japan, Hong Kong and Singapore, exchanging detailed and complex design drawings, prototype plans, test results, and production and shipment schedules. This greatly facilitates their ability to check demand and supply levels, and respond quickly to potential mismatch problems. It also helps shorten their new product development times. With the use of Alliance, Adaptec's cycle time was cut by more than half.

In another example of planning synchronization, Cisco has embarked on a very ambitious project to create an e-Hub linking multiple tiers of suppliers via the Internet. It is intended to coordinate supply and demand planning across the supply chain, using intelligent planning software provided by Manugistics. The e-Hub will also help identify potential supply and demand problems early, give proper warning to the appropriate parties, and permitting prompt resolution, all via the Internet.

b) IP and Knowledge Sharing

Other new companies have emerged to support new product designs and new product introduction through collaboration and sharing of intellectual properties. One example is Spin Circuit in the electronics industry. By creating a Universal Data Network for design data such as EDA CAD libraries, MUP/ERP and PDM, approved vendor lists, and design data sheets, design engineers and manufacturing engineers can collaborate to speed up the design and introduction process. The Internet has thus played a key role in supporting companies to "design for supply chain management."

The Internet is also enabling innovative ways to leverage knowledge capital critical to the design process. For example, Boeing, TRW and Monsanto used Yet2.com's Web site to collaborate and trade intellectual properties among partners, saving millions of dollars on research and development.

c) Profits Follow Collaboration

As with information sharing, synchronized planning pays big dividends for those willing to make the investments. The Nabisco example is just one of many examples.

The survey found that companies reporting higher than average profits are also more engaged in joint logistics replenishment and planning programs with their trading partners. Grocery manufacturers Campbell Soup and Procter and Gamble, and retailers Hannaford Brothers and H.E. Butt, have also found that synchronized replenishment programs improved their inventory turns.

V. Electronic Workflow Coordination

The Internet permits companies to take collaboration one steps further, through coordination, integration and even automation of critical business processes. Workflow coordination can include activities such as procurement, order execution, engineering change, design optimization, and financial exchanges. The result is much more cost-effective, speedy, reliable and less error prone supply chain operations. Below, we offer a number of examples of how different companies are pioneering workflow coordination activities in these and other areas.

a) Procurement

A typical manufacturing company needs to procure thousands of products from hundreds of suppliers. The Internet helps to manage the complexity of the procurement process. Numerous companies including Ariba and Commerce offer Web-based enterprise procurement solutions that dynamically link the buyer into real-time trading communities over the Internet. They also automate the internal procurement process from requisition to order, as well as the supplier interactions from order to payment.

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The solutions enable companies to reduce operational costs and increase efficiency by automating the entire indirect goods and services supply chain. Indeed, most of the market exchanges, such as Covisint for the automobile industry, Exostar for the aerospace industry, Converge and e2open for the electronics industry, and Transportation for the grocery industry, provide e -procurement solutions for their members.

Increasingly, companies are also relying on scientific replenishment1 software to drive the timing and quantity decisions in procurement. For example, Longs Drug Stores, a retail pharmacy chain, uses the service of Nonstop Solutions to manage its ordering and replenishment processes at their distribution centres and stores. This results in inventory turns that are head and-shoulders above the competition. Longs' supply chain has been dubbed the "hyper-efficient pharmaceutical demand chain."

b) Order Processing and Financial Flows

Instil, a Silicon Valley start up company, has created an Internet-based service to facilitate and process orders, as well as coordinate rebates, discounts, and other financial exchanges for operators (like restaurants), distributors and manufacturers in the foodservice industry. Its mission is to develop easy-to-use services that lower costs and provide valuable information for all members of the foodservice supply chain. Its solution replaces the traditional time-consuming, error-prone purchasing systems with a secure and user-friendly client program for food operators to order food products on the Web. In addition, the Web site serves as an information hub that links buyers and suppliers in the food service market

c) Procurement Coordination for New Products

Sourcing parts for new products can be a major hurdle to timely and profitable new product introductions. Using the Internet, companies can conduct complex purchasing tasks — such as parts-list management, quoting, decision-making, ordering, and order change and order confirmation— in hours instead of days. The Internet also lets companies tap into a bigger supply base to ensure dependable supply and backup sources. Timeliness in supplier selection, order quote generation and receipt, and the integration of purchasing decisions with a company's internal Enterprise Resource Planning systems are particularly valuable in new product introduction.

Solectron, a leading contract manufacturer and unprecedented two-time winner of the National Malcolm Baldrige Award, made use of Digital Buyer, an Internet-based procurement software application provided by Digital Market (now part of Agile Software), to reach multiple suppliers and obtain price and availability quotes. In its pilot with Digital Buyer, 5 out of 6 suppliers responded in as little at 4 hours to requests for quotes for 55 parts. Within two days, the company had received a total of 156 quotes, a dramatic improvement over traditional methods.

The end benefit is drastically reduced cycle time to support Solectron's customers' new product introduction process.

d) Engineering and Product Change

As product life cycles grow shorter and shorter, managing product rollovers — the transition from one version of a product to another — is now a routine challenge faced by many high tech companies. Product rollover can be a vulnerable time for a company, exposing them to significant loss of market share if mismanaged. A major risk is the time taken to have all the new parts ready for the rollover. Engineering changes involved in rollovers may require both new suppliers, new bills of materials, and new requirements for existing parts. Companies in fast changing markets, like Dell Computer, Pair Gain, WebTV and Flextronics use an Internet-based solution from Agile Software to streamline engineering changes. Product changes — updates, enhancements and patches performed between product versions — are equally common events in the high tech industries. These changes can be due to component cost change, product improvements, process modifications, quality feedbacks, material shortages, and product obsolescence. Product changes involve the collaboration of design engineers, procurement, suppliers, manufacturing and process engineers, contract manufacturers, service support, and product management. Here, again, Internet-based solutions can play a key role, providing a platform for coordinating and streamlining the complex activities entailed in product changes.

VI. New Business Models

Once companies begin to realize the promise of e-business enabled supply chain integration, they often discover entirely new ways of pursuing business objectives, developing strategies and business models that were neither apparent nor possible prior to the Internet. These new business models and opportunities are as limitless as the imagination. The following examples show the range of possibilities.

a) Virtual Resources

The Internet facilitates information search so that multiple resources in a supply chain that once acted independently can now be tapped simultaneously to satisfy special needs. Examples include inventory stockpiles, untapped capacity, or even unmet demand, all of which can be pooled to create a secondary market of "virtual resources." Such secondary markets can create high value for participants by minimizing imbalances between supply and demand and reducing exposure to inventory obsolescence.

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Internet-based secondary markets can thus benefit, in most cases, every member of the supply chain.

One example of a virtual resource is World Chemical Exchange, an electronic marketplace operated by Chemical Connect providing a global market for chemical and plastic manufacturers and buyers.

More than 2,500 members, representing 80 percent of the world's top 25 chemical companies, now can conduct round-the-clock trading of chemicals and plastics of all types Converge operates a market exchange for the secondary market of electronics components. Since the high tech industry has very short product life cycles, excess inventory of components and parts can result in huge obsolescence costs, while suppliers and manufacturers are not always able to produce more of their products that are close to the end of the product life cycle.

Converge minimizes such exposure by providing an open virtual marketplace for buyers and sellers.

b) Supply Chain Restructuring

With the advance of information technologies, companies can also restructure the logistics flows of their products to gain efficiencies.

Physical flows no longer have to follow information flows: the Internet allows information flows to substitute for some of the inefficient physical flows. Cisco has been one of the most successful companies engaged in using the Web to this end. With 74% of its sales conducted over the Internet, the company outsource most of its manufacturing while devoting sales efforts to creating new customers. An elaborate Web-based information system links Cisco and its supply chain partners, and takes care of all the necessary information flows. But the physical flows can be quite simple – 55% of Cisco's sales are shipped directly from the subcontract manufacturers to the customers, without stopping at Cisco's distribution centres. The result: lower inventory, faster, more accurate order fulfilment, and reduced costs.

c) Product Upgrades

Most of us are familiar with the use of the Internet to perform upgrades to software products. But some innovative companies are exploring ways to use the Internet to upgrade hardware products, as well. Xilinx is a semiconductor company producing field-programmable logic devices. Some of the products in which Xilinx integrated circuits reside are going through constant product generation changes that would require onsite updating or even physical replacement. To address this problem, Xilinx developed Internet-Reconfigurable-Logic (IRL). With IRL, the field programming logic can be modified or updated after the installation at the end user's premises over networks and the Internet. These online field upgradeable systems can range from multi-use set-top boxes and wireless telephone cellular base stations to communications satellites and network management systems. Today, Xilinx is the market leader for field programmable logic.

d) Mass Customization

The Internet enables many companies to use the Web to allow customers configure specific order options tailored to the tastes and preferences of the customers. Hence, the Internet facilitates mass customization. This has been a key feature of online retailers, but has now spread too many mainstream business and products. Examples run the gamut from personalized greeting cards (e-Greetings, now part of American Greetings), to computers (Dell), from bicycles (Cannondale and Voodoo) to automobiles (Ford and GM). Mass customization, while not appropriate for every product or industry, can be a powerful way of cementing customer relationships by providing a highly cost-effective level of personalized service.

e) Service & Support

Service and support can be a time-consuming, costly diversion for many companies. Using the Internet to perform remote sensing and diagnosis has proven to be a highly cost-effective solution. Looking at the PC support area, a software company called tuneup.com developed a remote maintenance service aimed at helping individual and companies keep their PCs running. A subscriber of the service allow the service centre to remotely collect data on her computer, checking viruses and other anomalies, alerting the customer, and providing online fixes.

They also advise and help the subscriber to install software upgrades, hardware drivers, and program add-ons specific to her computer. Subsequently acquired by Symantec and re-dubbed Norton Web, this remote service approach has been adopted by a wide range of end-user and enterprise service companies.

Under an "Auto test" program, Cisco's suppliers run software routines that perform quality tests at their local test cells. The test data are sent over the Internet to Cisco, so that Cisco engineers can remotely monitor and control test cells. This enables them to resolve problems that the suppliers themselves cannot diagnose.

The standardized test results across the entire supply base allow Cisco to scale the activity rapidly and obtain valuable information about their products that might not be available without such an arrangement.

f) From Products to Service

Intuit develops and markets the world's best-selling personal finance, small business, and tax preparation software, as well as a set of Web-based

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financial tools. In the past, the company offered only software products sold primarily through retail stores. With the advance of the Internet, Intuit has been able to create Internet based services for both individuals and businesses. These range from online tax preparation and form submission to payroll, office supplies procurement, mortgage brokering, insurance, electronic bill payment and much more.

In addition, since Intuit has links to many key banking institutions, it can also access the appropriate data, such as dividends and interests payments, and include them in the electronic tax filing.

The revenue from services, enabled by the Internet, is steadily increasing as a percentage of Intuit's overall revenue. Delivering these services to customers via the Internet is only the most visible aspect of this strategy. Behind the scenes, Intuit uses a range of Internet tools and solutions to link and orchestrate a vast supply chain of providers, from banks and brokerage houses to independent mortgage brokers, from insurers to office supplies retailers like Staples. Without the Internet, Intuit's transition to a service-based company would not be possible.

g) Multi-channel Click-and Mortar Fulfilment

The high cost of order fulfilment for online retailers has been viewed as a major impediment to success. Traditional "offline" retailers are pioneering the combination of the digital channel with traditional brick-and-mortar infrastructure. 7dream.com in Japan is an example of such a "click-and-mortar" multi-channel model.

Seven-Eleven Japan (SEJ) is the largest and most successful convenience store chain in Japan. In 2000, SEJ created 7dream.com, a joint venture involving seven of Japan's industry giants: SEJ, Nomura Research Institute (NRI), Mitsui, Sony, JTB, NEC and Kino trope. 7dream offers a large pool of products on its Website, allowing customers to pick up orders at a local SEJ store two or three days later. In this way, the value of Internet-based channel is combined with the power of SEJ's infrastructure of extensive stores and logistics without incurring the costs and risks of carrying an expanded range of inventory.

Another example of click-and mortar multi-channel fulfilment is CVS, a major US pharmacy chain. CVS allows customers to place prescription orders on the CVS Web site and pick up their orders at their local store, eliminating wait. In another example, Toys RUs leverages the logistics infrastructure of Amazon.com for order fulfilment, while customers can order directly from the company via its Web site. Many others like the Gap and Lands' End are developing similar click-and-mortar multi-channel fulfilment and distribution strategies.

VII. Supply Chain Monitoring and Measurement

The ultimate value of supply chain integration can only be achieved if all partners trust that they will see returns commensurate with the effort invested. Moreover, they must not perceive that their participation puts them at a competitive disadvantage, either against other members, or against traditional competitors. The more complex and dispersed the supply chain, the more difficult it is to balance the needs of all parties. To assure mutual trust and optimum performance at every point in the chain, monitoring and measurement emerge as critical success factors.

a) A New Industry Based on Trust

Monitoring supply chain performance is an intriguing new field. Terms like Supply Chain Event Management, Supply Chain Process Management, or Supply Chain Execution Management are used interchangeably for this purpose. Supply chain monitoring must start with tight tracking of the many different processes involved in a supply chain. A number of new technology solutions are appearing to provide updated information on how products and information flow through the different parts of the supply chain. A few of them are described below.

b) Manufacturing

In manufacturing processes, Data Sweep has created a sophisticated system to track manufacturing data, such as capacity, yield, work in process, and machine status, etc. Such information can then be transmitted via the Internet to appropriate parties, and hence provides the foundation of manufacturing process monitoring.

c) Transportation/Logistics

Savi Technologies is an example of a company that makes use of RFID (Radio-Frequency Identification) technologies to track individual products, containers like totes or pallets, and transportation vehicles, as they move through key choke points along the supply chain (such as a warehouse, a dock, or an airport.) The information is put on a common Internet platform, so that total visibility of end-to-end real-time movements can be obtained. The company's new offering, Smart Seal, provides secure monitoring of products against tampering or thefts. It also enables customs clearance to be carried out effortlessly, once the security of product contents is assured.

d) E-Hubs as monitoring Systems

Tight monitoring enables companies to detect problems early, so that corrective actions can be taken promptly. The e-Hub concept, described earlier, that Cisco and other companies are undertaking can be viewed as a supply chain monitoring system. Many other new ventures, such as World Chain, Sourceree,

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and Vigilance, as well as established players like EXE, Vastera and Descartes, are providing monitoring services using the Internet platform.

e) Procurement and Contract Compliance

Monitoring often requires tracking of supplier performance and contract fulfilment.

The foodservice market exchange Instil, mentioned earlier, provides this service for their customers. For example, a food operator such as the Marriott may have a contract with a food supplier, stipulating pricing terms based on the aggregate purchase of the products by Marriott hotels and operators (who often also make independent purchasing decisions). It is in the interest of Marriott headquarters to monitor the compliance of the contract by the individual hotels and operators in order to ensure best prices and uniform quality. Instil now offers a purchase tracking service for multi-unit foodservice operators, and allows executives of food operators to view up-to-the-minute purchasing activity for better control.

Manufacturers, for their part, must have access to the aggregate demand and tracking data showing how their products move through each distribution channel. Provato (now part of I-many) and DiCarta are other examples of companies that provide Internet-based software solutions to help companies construct and monitor compliance of contractual agreements.

f) Cross-Chain Monitoring

Supply chain integration also requires performance measures that go beyond a company measuring its own performance. As companies share demand information, collaborate on planning decisions, and exchange decision rights for supply chain integration, it is important that performance is not measured locally, but that performances at different parts of the chain are shared to all appropriate parties. The Internet can again be used to facilitate performance measurement across a supply chain. For example, See Commerce was instrumental in helping DaimlerChrysler's service parts division, the Mopar Parts Group, improved its service performance drastically.

Internet-based software product, the See Chain suite, was implemented by the Mopar Parts Group to monitor performances at multiple parts of the service supply chain. The investment paid back in only 12 weeks.

VIII. The Next Wave: Market Intelligence and Demand Management

As tools and techniques for managing the supply side of the equation mature and become more widely adopted, companies will turn to managing demand as the next way to optimize resources and performance.

The application of e-business practices can provide a massive set of demand data with great value potential. Data mining, data marts and other database analysis techniques have long provided companies with the ability to derive business intelligence from internally generated sources. Statistical aggregation of consumption data from multiple sources can provide market information for manufacturers and suppliers essential to planning merchandising decisions, promotion plans, and new product development decisions.

In still's suite of Internet services, used by an extensive set of distributors and operators in the foodservice industry, for example, enables business intelligence. The company consolidates industry-wide data and offers business intelligence information as a service to customers for improving their profitability and market positions.

Another example of using demand data to create business values is Demand Tec. Using extensive data, the company's proprietary scientific methods, based on sophistically statistical analyses and optimization techniques, can analyze customer demand characteristics, and help companies to optimize their demand management decisions, such as merchandizing, pricing, promotion plans, and assortments, etc. The optimization is based on nonlinear programming techniques, capturing the interactive effects of products, stores, marketing instrument decisions, and time, as well as the supply chain cost impacts resulted from the demand management decisions. Such a powerful solution is made possible due to the existence of extensive demand data.

The combination of comprehensive demand data and transparency across the supply chain opens the door to the next stage in supply chain integration: demand management. While many view demand as a murky and unpredictable variable in their attempts to plan, there are many opportunities to tune and manage demand to bring it into concert with the rest of the supply chain. Armed with up-to-the-minute capacity and resource data, companies can target demand creation programs such as discounts, rebates, regional or niche marketing to stimulate or dampen demand. Look for new initiatives and technology solutions in this area in the near future.

IX. Conclusion

E-business has been a powerful and compelling enabler of supply chain integration across a wide range of industries. As a result of e-business, many of the core supply chain concepts and principles have been put in practice in a much more effective way. These concepts include: information sharing, multi-party

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collaboration, design for supply chain management, postponement for mass customization, outsourcing and partnerships, and extended or joint performance measures. The Internet has allowed companies to come up with highly innovative solutions that accelerated the widespread adoption of these core supply chain principles.

In the next few years, we will see an explosion of business-to business applications of the Internet as visionary companies develop new paradigms of e-business for the future. Many have already found ample opportunities in e-business. Such advancements have accelerated the movement towards supply chain integration. The landscape of such integration efforts will be very different from the traditional ones. Companies that make use of e-business to redefine supply chain integration will achieve significant increases in efficiency and gain tremendous competitive edge over their competitors.

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