Abstract —The interest of both researchers and practitioners around the use of Internet-based technologies to support the supply chain management has been very high. But it is still not quite clear how to apply the e-business strategies to the reality of the software focused supply chain management. The software focused supply chain is a supply chain of software focused products and services. In this paper, four e-business strategies for the software focused supply chain management are identified. These e-business strategies arise from survey of literature on e-business and software focused supply chain management.


I. INTRODUCTION

Software focused supply chain is a supply chain of software focused products and services ([1], [3], [16], [21]). A software focused product consists of hardware component and software component, where the software component is either the higher value part of the product, or the major innovation of the product, or the main differentiator of the product. The movement of hardware components of software focused products is taken charge mainly by conventional enterprises in traditional supply chain while the development, delivery/distribution and maintenance of software components of software focused products are mainly supported by web-based virtual enterprises (see Fig.1). Software focused supply chain emphasizes “software” flow and integration of “hardware” and “software”. This area has only recently been receiving some attention from the research communities and is expected to rapidly gain importance as more and more traditional manufacturers increase the software content in their products ([1], [5], [16], [21]).

For many Hi-Tech products, the software component is becoming more and more important in the differentiation, customization and capability upgrades of the products as the hardware becomes commodity. Thus, the software constitutes the major innovation and value of the products. The same hardware can be produced or sourced and delivered to different customers, but the real value is based on the software configuration and customization. For example, for some cars, the same engines are sold for different capacity of horsepower. To extend the capacity, dealers just need to upgrade the software instead of changing the hardware of the engine ([1], [16]).

In industries ranging from computers, mobile phones and medical devices to automobiles and avionics, firms are repositioning their products by bundling physical goods with value-added software-based features. The introduction of these features, typically created as stand-alone software modules, requires a range of specialized software skill sets. The economics of software development underlying such bundling favours the use of outsourced software developers. Firms that commit to offering such product bundles need to coordinate the largely outsourced development of the software features with the design of their core physical products ([4], [10], [16], [17], [20]). Coordination, in this context, incorporates two related activities: first, assembling needed resources, and second, managing the integration of software and internal physical product development within the company and across the different external software suppliers.

Current OEM practice is to source software components from its suppliers similar to hardware parts. The OEMs have to establish partnership with their vendors for software development and delivery. The management of the relationship, product development, order planning and scheduling, and shipment has significant impact on the overall performance of the company. As long as software components could be handled as hardware parts, general theories and practices of the supply chain management are valid and applicable. However, there are significant differences between hardware product flow and software product flow and their management practices. The software development, delivery and installation processes can be very different from hardware as different technologies and delivery channels can be used for software focused supply chain. Therefore, there is a definite need to create specific theory and practices suitable for effective management of software focused supply chain.

In this paper, we focus on the Internet-based e-business strategies for the software focused products and service supply chain and proposed major e-business strategies for the software focused supply chain management. We classify the major e-business strategies into four major categories: eDesign, eCollaboration, eDistribution, and eService (see Fig.2). These e-business strategies arise from survey of literature on e-business and software focused supply chain management, which are important from cost management and revenue generating perspectives in information age.

II. E-BUSINESS STRATEGIES

Metric units are preferred for use in IEEE publications in light of their international readership and the inherent convenience of these units in many fields. In particular, the
use of the International System of Units (SI Units) is advocated. This system includes a subsystem the MKSA units, which are based on the meter, kilogram, second, and ampere. British units may be used as secondary units (in parentheses). An exception is when British units are used as identifiers in trade, such as, 3.5 inch disk drive.

Internet-enabled supply chains can reach out to a bigger market; perform mass customization to tailor product and services to meet the individual customers' needs and develop new products and services that adapt to the competitive and environmental needs. The Internet changes the way in which supply chains are managed, planned and controlled. The information, decisions and processes that form supply chain management are moving to the Web, breaking old paradigms of inter-company boundaries. This common ground will be where entire supply chains truly can be synchronized. New upstart specialist providers of both virtual and physical activities will carve out their own unique roles in the new infrastructure. In this environment, supply chain capabilities will be crucial. But gaining those vital competitive capabilities will not be through the typical supply chain initiatives of today.

### A. eDesign

In the 21st century e-business environment, market is turning to more customized and the product life cycle is becoming shorter and shorter. This makes design more dependent on the need of market, i.e., the design of products is highly relevant to demands of customers. Customers no longer willingly accept whatever product is available. They now demand products to match their specific needs. This demand-driven environment is compelling companies to improve their business process through the latest Internet technology ([2], [14], [17]).

More and more products have build-to-order or configure-to-order choice. Chen et al. [2] consider the configure-to-order mechanism under a batch mode available-to-promise policy which directly links production resources with customer demands and affects the overall performance of the supply chain. Shorter time-to-market, enabled by collaborative design via Internet, is of great value to most companies, since the profit margins in the early part of the product life cycle are greatest and the potential sales gains from being the first to market are tremendous. Web-based supply chain provides real-time linkages between key suppliers, manufacturers, engineers and marketers. The ability to conduct eDesign means that companies can iterate many more design alternatives with suppliers. Product upgrades can also be achieved more effortlessly and in a timely manner, enabling companies to stay ahead of their competition ([8], [12], [13]).

### B. eCollaboration

Many high-tech companies from computer to telematics manufacturers are faced with the question of how they are going to do business in an Internet economy. They have to discard the old business model and rethink how they interact with their customers, suppliers and other partners. For example, you may connect your suppliers, creating a virtual enterprise that can seamlessly support the needs of your customers through Internet ([8], [10], [11], [19]).

Collaborative planning, forecasting and development have shown the advantages to be gained from business partners who collaborate on the development of software
focused products ([8], [15], [18]). This type of development is crushing old paradigms of “ownership” of key strategic, planning and operational information. Planning can be done in collaboration with customers, suppliers, contract manufacturers, assemblers, shippers and others through open sharing of relevant database. The significant benefits of sharing information with business partners are enticing companies to build trust levels and release key information from their private ownership.

eCollaboration for software focused product development can shorten product development, error reductions, reuse of existing design, better cross functional and cross organizational cooperation. Therefore, it can shorten the whole product life cycle and reduce total cost along the overall supply chain. Moreover, eCollaboration reduce the frequency of late changes in the product development stage, which allows better decisions at the early stage of the product development process. Since eCollaboration enhances multiple interactions between participants, it may very well improve their creativity, given that creativity mainly happens in interaction.

**Notes:** SW – Software, HW – Hardware

Fig. 2. Four e-Business strategies and their impact on the software focused supply chain

eCollaboration also allows software focused supply chain participants to create a “virtual” store of inventory that each participant can access to satisfy customer needs from any available source. Full knowledge of availability across the supply chain will allow these participants to reduce costs through lower stocks and more efficient supply planning.

Johnson and Whang [9] define eCollaboration as B2B interactions facilitated by the Internet. These interactions go beyond simple buy/sell transactions and may be better described as relationships which include activities such as information sharing and integration, decision sharing, process sharing, and resource sharing. Lee and Whang [13] also provide this definition of eCollaboration and link the idea to earlier research in supply chain management.

**C. eDistribution**

Increasingly, high-tech companies are moving from physical channels of distribution to electronic pathways ([6], [7], [9]). For example, a firm that manages software focused supply chain, in the sense that it offers a product that has both a bundled software and hardware, may have digitized the software piece of its business across all of the supply-chain buckets. Using the latest Internet technology, a company speed and simplify software focused product sales and delivery. Customers can receive software components of a product physically or download them directly to their desktops or laptops through the Internet. Orders can be tracked by customer, region, or product in real time and payment can be via credit card or pre-approved purchase order numbers. A truly efficient end-to-end supply chain enabled through the Internet will be a significant improvement in cash flow that can reach into the hundreds of millions of dollars in larger companies.

For software focused products, distribution of software components have great impacts on the overall supply chain performance. The final invoicing is not made when hardware is on site, but only after the customized software is installed and running without problems ([16], [21]). To reduce Time to Cash, the lead-time of software focused supply and delivery is crucial.
D. eService

E-service in software focused supply chain management includes the subscription management, software component update and lifecycle management & licensing support ([7],[20]).

Subscription management includes the collection of customer registration fees, delivery of monthly subscription releases, plus handling of scheduled software updates, and keeping technical support contracts.

Software component updates service brings customers new versions of their own software and selected third-party software products, patches, and technical manuals. And it includes licensing to use and copy the new versions. Updates for third-party and selected their own software components are automatically forwarded to customers via the Internet. Customers will be notified when new versions of other software products become available, allowing customers to choose whether they wish to receive updates. Subscription-based purchasing gives customers substantial savings vs. the cost of individual software updates ([7],[21]).

Web-based lifecycle Management & Licensing Support can cut costs and streamline operations with complete, single-source software product lifecycle management services. It helps customers to analyze their existing operations, recommend and implement improvements, and follow through by managing the overall publishing and fulfillment process. The issues associated with tracking, licensing, and managing software throughout enterprise can seem overwhelming.

III. CONCLUSION

Software focused supply chain is a supply chain of software focused products and services. A software focused product consists of hardware component and software component, where the software component is either the higher value part of the product, or the major innovation of the product, or the main differentiator of the product. In the information age, issues of integration, coordination and optimization of software focused supply chain management via Internet become more and more important for both researchers and practitioners. In this paper, we investigated e-business strategies for the software focused products and service supply chain and proposed major e-business strategies for the software focused supply chain management. We classified the major e-business strategies into four major categories: eDesign, eCollaboration, eDistribution, and eService, which can improve the business processes from design to market, shortening the whole product life cycle and reducing cost of whole software focused supply chain.

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REFERENCES


