Supply Chain Synchronizing Through Web-Centric Product Content Management

In the drive to improve supply chain performance, managers in diverse industries have achieved substantial gains by sharing information. Much of the excitement has focused on making inventory and product movement data transparent throughout the supply chain. More recently, companies have also found that sharing information related to market intelligence and promotional plans can dramatically improve forecasting, smoothing the replenishment process. Yet with so much energy focused on inventory and sales data, relatively little attention has been given to sharing information about the product itself. This is about to change! What started as a move by manufacturers to automate the engineering change process is now being fueled by initiatives throughout the supply chain, from trading exchanges to third-party logistics providers.

Introduction

Over the past two years, manufacturing firms in many high-paced industries like computers and electronics have begun to realize that synchronizing material flow and demand signals alone will not eliminate bullwhip inefficiencies. To tame the bullwhip, they also need product content synchronization. To understand why, imagine a tightly coupled supply chain where inventory and sales data traveled instantly to all partners, allowing material to be quickly pulled from suppliers and manufacturers through distribution and to the final customer. Orders arrived on time and in the correct quantities, but the products were assembled to specification from an obsolete revision, or worse yet, they contained components from inferior vendors causing system conflicts or quality defects. Scrambling to rework defective products, other orders fell behind and delivery performance suffered while millions of dollars of supply chain losses were incurred through write-offs of obsolete products and components. While synchronizing material flow and demand is a key element in effective Supply Chain Management, maintaining up-to-date product content information across the supply chain is equally important.

Managing Product Content

Product content information is all the data needed to manufacture a product to the correct specifications and at the most recent release. This includes such details as the bill of materials, drawings, lists of approved manufacturers for each component, and process information needed by manufacturing to build and test a quality product. Typically, bills of materials (BOM), which are lists of parts and sub-assemblies that make up a product, are arranged in a hierarchical format. For example, at the highest level is the final product. The next level of the BOM consists of major sub-assemblies followed by the smaller assemblies and components that make up each sub-assembly. Accuracy of this information is critical for procurement to buy the correct parts and manufacturing to assemble the right product.

The need for product content synchronization has exploded as industry after industry disintegrates into a string of outsourced services coordinated by virtual manufacturers. In firms where marketing, R&D, procurement, manufacturing, and distribution are co-located on a single site, synchronization (and collaboration) can occur without good information management. In

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the early idea stages of a product, designers can propose ideas over coffee with colleagues in marketing and manufacturing. During a new product introduction, manufacturing engineers can stroll down to R&D whenever questions arise. When changes occur in the design or sourcing of material, development and procurement specialists can run downstairs to the shop floor to be sure the changes are understood and will not create production conflicts.

However, today few companies have such control over their products. More likely, designers are in Boston, assembly is outsourced to Southeast Asia, components are procured from an array of global firms, and distribution is handled by third-party providers who not only fulfill orders but also customize the products for unique customer needs. For OEM manufacturers, product licensees each have their own unique design needs, marketing issues, and distribution requirements. Each partner in the chain must, at a minimum, have accurate, current product content information. Yet in many supply chains, critical product content information is often transferred in a hodgepodge of drawings, CAD files, spreadsheets, and text documents. Poorly managed product content information is a key source of supply chain headaches.

For example, consider WebTV, who designs, manufactures, and distributes TV set-top boxes that allow customers to use their televisions to surf the Web. Throughout the life of the product, speed
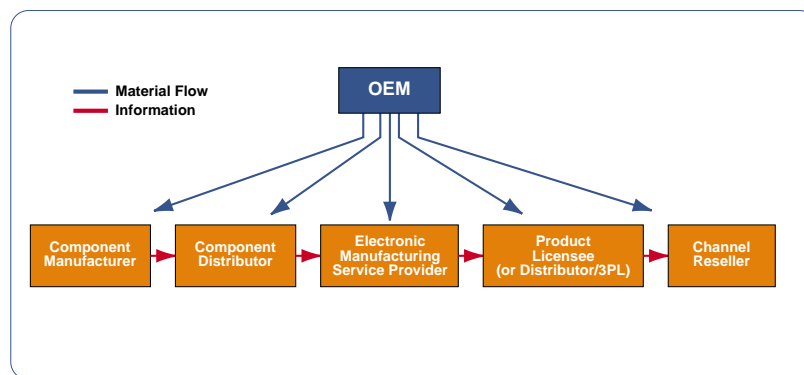
Figure 1.0   A typical virtual supply chain in the computer and electronics industry.

is critical – both in bringing the product to market and in responsively changing and customizing the product for customers needs. For these supply chains, everyone from R&D through distribution requires immediate access to accurate, up-to-date product content information. And, like many high-tech companies, WebTV manages a complex supply chain without ever physically touching the materials or product. Starting with component manufacturers like Toshiba, to component suppliers like Marshall, then to a electronic manufacturing service (EMS) provider such as Flextronics for assembly, and through licensees like Sony out to the retail channel, WebTV coordinates material and information flows (see Figure 1.0).

For virtual firms, managing the information needed by each player in the supply chain is by far the biggest challenge. One slip in the information relay race and products are assembled with the wrong parts or orders pile up waiting for components. For example, consider a typical blunder made by an OEM who designed and marketed an electronic product. In a move to improve the functionality of the product, designers at the OEM made a routine change in one key specialized component that was supplied from their component distributor. The procurement managers at both the OEM and the manufacturing partner made the change and started ordering small quantities of the new component from the distributor. However, because the product content data was not integrated with the procurement

systems, no one updated the forecast for the new component to reflect the ramping volumes that were planned. Since the distributor and manufacturing service provider did not realize the oversight, no plans were made with the component manufacturer to ensure the needed quantities would be in place. The component distributor had a small number of the components in inventory and quickly delivered initial orders, giving the manufacturing service provider the feeling that the part was readily available. Finally when a large order for the component was placed, the distributor realized the mistake, but it was too late. The component manufacturer could not deliver the component in time for the pending ramp-up. For the OEM, this meant having to go to the licensee and explain why the new product would have to be delayed for several weeks. The licensee had already planned a major product rollout supported by advertising and had made many promises to its retail channel partners. After tense negotiations, the component manufacturer offered to switch production at one of its plants to expedite the chip, but at a cost of $3 million. In the end, rather than delay the product introduction, the three partners, the OEM, EMS, and distributor, split the cost and expedited the chip.

While not all coordination mistakes are as costly as this one, the cumulative cost of many smaller mistakes is significant. Even managing simple tasks, like the approval process for engineering changes, is a nightmare in many organizations.

Sharing product content information → Faster design change propagation through Supply Chain → Faster reaction from suppliers, manufacturing partners, and distributors → Material flow synchronization → **Decreased Supply Chain Costs**
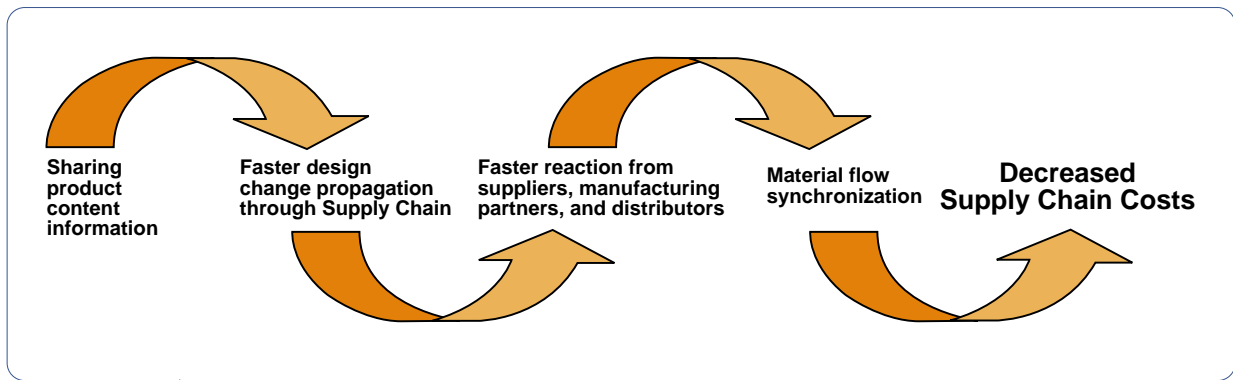
Figure 2.0 | Sharing product content information reduces procurement and inventory costs.

Proposed changes are often routed by fax, phone, e-mails, and meetings to capture the necessary signatures to be released to manufacturing. Once released, changes often come as a surprise to manufacturing and sourcing partners, adding cost and time. On a routine basis, mistakes that create short delays in component deliveries to the EMS mean that reserved capacity at the EMS will go idle waiting for the part. In cases where the delay is clearly related to stumbles in the OEM product change process, the EMS may ask the OEM to help pay for the cost of the disruptions, typically $5,000 to $10,000 per day. Of course, these costs are peanuts when compared to the substantial effect on total supply chain cost and potential lost revenues from delayed products.

Product Data Synchronization

Tortured by supply chain costs related to product content, manufacturers in many industries have worked to improve their data management practices. Some firms like Hewlett-Packard and General Motors created their own homegrown design tools to help better coordinate designers and manufacturers. Many third-party companies including CAD and workflow software vendors also jumped into product data management market. Yet maintaining up-to-date product content is not enough. The information must be shared with supply chain partners. A myriad of proprietary systems, while improving data quality, often hinders coordination between supply chain part-

ners. The Web is quickly changing that.

Product collaboration software vendors such as PTC and Agile Software are rapidly evolving into Web-based services that dramatically improve the ability of the supply chain members to communicate and collaborate with one another about new or changing product content. By bringing together all product content including drawings, bills of materials, approved vendors, process instructions, and a complete product history into a single portal, Web-centric systems automate many painful tasks. For example, using a system like Agile, a designer making an engineering change can work through a Web browser to create the proposal. For each change, comments and product history is included so anyone examining the product can see why changes were made. When the proposal is complete, the software simply tosses an e-mail containing a hyperlink to the proposed change to all of the people on the product team. By clicking on the hyperlink (with appropriate security), those who need to approve the proposal can see the changes, including drawings and product history. If the approvers agree with the change, they simply click an acceptance button and their response and comments are recorded with the proposal. After that, anyone who looks at the proposal can see who has accepted it thus far and who has not yet registered an acceptance or rejection. When all the required team members have approved the change, the Agile system will automatically

notify everyone related to the product that the change has been approved and release it to manufacturing and procurement.

Many of the early adopters of product management systems were primarily interested in automating the engineering change process. However, they quickly learned that product content synchronization would lead to material flow synchronization with big supply chain dividends. An early adopter of Web-centric product management was PairGain Technologies, who designs, manufactures, and markets DSL (Digital Subscriber Line) networking systems. Service providers and private network operators worldwide used PairGain's products to deploy DSL-based services, such as high-speed Internet, remote LAN access, and enterprise LAN extensions over the existing infrastructure of copper telephone lines. In the past, the process for releasing new products and product changes was manual and time-consuming. It required many meetings and extensive travel between PairGain and its manufacturing partner SCI. The labor-intensive activities slowed product development and caused many expensive mistakes. After using Agile's Web-centric product, the need for frequent design meetings evaporated. Both within PairGain and at SCI's manufacturing plant in Brazil, engineers could interact daily with an ongoing dialog about product content.

Along with the improved product content collaboration, PairGain also restructured its supply chain to synchro-
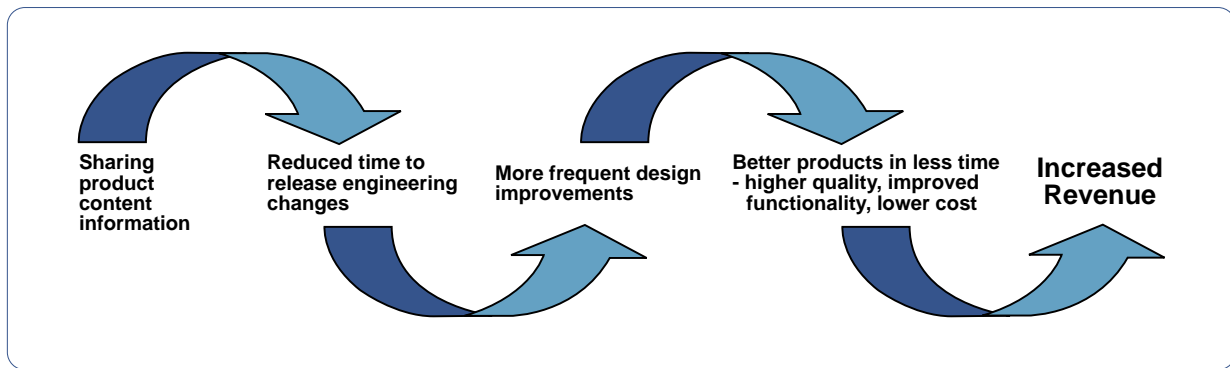
Figure 2.0 | Sharing product content information enables supply chain partners to develop better products, enhancing revenue.

nize the flow of information, material, and cash, reducing inventory and slashing costs. In the past, the supply chain often held up to six months of component inventory, making changes to the product very slowly. By 1999, with only a few days of inventory in the pipeline, product changes could be made within one week. Since component prices were constantly dropping, PairGain was able to reduce its purchasing costs by not making procurement decisions months in advance. In fact, on many standard components, payment was made electronically upon consumption. Its component supplier, Arrow Co., held inventory at the SCI plant in Brazil and delivered just in time to the production line. For PairGain, re-engineering the management of product content was a critical step in synchronizing the entire supply chain (see Figure 2.0).

Web-Centric Product Collaboration

As with many Web-based technologies, the initial changes aimed at automating cumbersome coordination processes led to far larger opportunities. As we have seen, synchronizing product data management translates into many cost savings. However, a far more interesting impact of a Web-cen-

tric approach is how it changes the process of content management. Traditionally, distribution of product content follows a push process with the design engineers making product design decisions and sending those decisions to others in the supply chain. In disconnected push systems, changes are expensive and thus are discouraged. Without instant access to content information, others within the supply chain operate with old information. More importantly, communication about product content is slow, hindering feedback from supply chain partners.

For example, if a designer specifies a new component or product change that makes the manufacturing process more difficult or affects the end quality of the product, it may take days or weeks for the supply chain partners to discover the issue and provide appropriate feedback. Automating the change process reduces the time and cost of engineering changes, making it possible to turn out frequent design improvements. Allowing supply chain partners to see the most recent information and suggest changes enables true collaboration and concurrent engineering where all supply chain partners participate in the design process. For example, a firm selling products worldwide could get feed-

back from regional partners, ensuring that the product would conform to local tastes and regulations well before the design is finalized. This leads to better products with fewer defects, improved functionality, and lower cost. The result is increased revenue (see Figure 3.0).

But why stop with product development process? By integrating product content management systems with B2B exchanges, designers and buyers could work together to rapidly develop new products. Neutral portals, such as those under development by Agile and PTC, that provide secure product management services could become gathering points for supply chain partners. Within the portal, partners could collaborate on the design process while being supported with a host of other services from procurement to contract manufacturing. From a proposed BOM linked to the exchange, component costs could be quickly established and procured using relevant trading technologies (request for quotes, reverse auctions, etc). Manufacturing and logistics services could also be evaluated and procured. Even after sales service such as spare parts and repair services could be outsourced and managed through such an exchange. Then we will have true supply chain synchronization!