



Connectivity

Enabling Visibility
in the Adaptive Supply Chain

Year 2004 Report on Trends and Issues in Logistics and Transportation





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Introduction

The University of Tennessee, Capgemini, and Microsoft are pleased to present this report based on the results of our 2004 research on connectivity in the supply chain. This report marks our 13th annual examination of the ongoing challenges that logistics and supply chain professionals face in conducting business.

The findings from this year's research indicate that significant opportunities exist for companies to become more "connected" to their suppliers and customers. Specifically, firms having real-time (or near real-time) information available about product, customers, and order fulfillment across the supply chain can achieve two significant objectives: improve customer service, and increase operating efficiencies and effectiveness. Not surprisingly, the currency of data and information affects both firms and their supply chain partners.

While these are good times to get that data and information, competing in the new information age requires executives to fully grasp the effect of new information technology, particularly in relation to their investments in legacy systems. Study participants reported that any new technology must be capable of increasing competitive advantage in terms of quicker and better decision making, visibility in the supply chain, and the availability of information between suppliers and customers.

This report is written for top management as a call to continue its efforts to create an adaptive supply chain that is noted for operations excellence. The focus of this year's report — connectivity — is essential for supply chains that are both tactically efficient and effective in meeting customer expectations, and that adapt to unforeseen circumstances.

Our research and this report would not have been possible without the support of a variety of organizations and people. This research benefited from the participation of CRST International, Microsoft Corporation, and Frank Quinn, Editor of *Supply Chain Management Review*. We also thank the many logistics professionals participating in the survey itself for taking time out of their busy schedules to share their knowledge and insights.

As we have stated since the beginning of this research effort on world-class supply chain excellence, the goal is to create an adaptive supply chain that is capable of rapidly responding to changing conditions and capable of competing effectively and efficiently in the new era of global business now upon us.

Sincerely,



Tony J. Ross
Senior Manager
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Mary C. Holcomb
Associate Professor
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Executive Summary

Conducting business in a global arena has created a great deal of complexity for logistics and supply chain professionals. Optimizing business performance in the midst of this complexity requires organizations to be both responsive and adaptive in order to sustain a competitive advantage.

In the past, many firms believed that information technology (IT) was the key to “optimizing” their performance. Today, we know that IT is not the only component. For every story highlighting a company that used IT successfully to compete, numerous other stories explain how companies failed using the same approach. This begs the question: “What makes the difference between success and failure?”

Here's the good news: Access to — and the availability of — supply chain technology have never been greater than they are today. The Internet provides easy and open communications between trading partners. It can also radically alter the economics of supply chain integration.

To date, the promises of business-to-business (B2B) and web-portal communications with suppliers and customers without human intervention has been largely unrealized. Instead, end-to-end connectivity in the supply chain is primarily through e-mail and the telephone. A better approach, and the challenge now, is to extract legacy data from multiple, disparate systems and to integrate them into an infrastructure. This infrastructure, which would include strong planning and execution tools, will provide visibility into supply chain processes in and outside the enterprise.

Herein lies more good news: Firms that have achieved the seamless integration provided by this infrastructure have seen gains ranging from internal operations excellence to superior supply chain performance. However, our research shows that a “technology investment divide” exists between “giant” companies and small firms. In 2005, the giants are planning to invest in radio frequency identification (RFID), supply chain event management (SCEM), and demand planning software. On the other hand, small firms are investing in a significantly different list of technologies: customer relationship management (CRM), demand planning, enterprise resource planning (ERP), supplier integration, and warehouse management system (WMS). Two other technologies seem to be off their radar screen, though: RFID and exception management.

The intent of this report is to provide firms currently connecting to the supply chain with a roadmap to increase their probability of success in using IT to compete. We believe that the differences between success and failure should not rest on the size of the firm alone!



Research Methodology

We researched how firms are using technology in the broadest sense — including information, tools and techniques, and business practices — to connect their supply chains across divisions and enterprises. The research identified where gaps and opportunities exist in achieving end-to-end supply chain connectivity.

Some 374 logistics and supply chain professionals participated in this study, which was conducted via the Internet. We also studied several national and multinational companies to better understand how they were working to increase the connectivity to their supply chains both internally and externally.

Participant Profile

This study polled a cross-section of industries, with manufacturers comprising 44% of the survey sample. Of this percentage, the high-technology and electronics sectors accounted for 18%; general manufacturing, 11%; consumer products, 12%; and aerospace/defense, 3%. Wholesalers, distribution, and warehousing companies accounted for 7% of the 374 respondents, while transportation providers and retail firms accounted for 6% and 5%, respectively.

Every function in the supply chain is represented in this study. Manufacturers and assemblers constitute the primary supply chain membership (26%), followed by end customers (21%), distributors/wholesalers (19%), and retail firms (12%). Tier 1 and Tier 2 suppliers also participated, representing 10% and 3%, respectively, of the total respondents.

Almost half of the participating companies (46%) have annual revenues greater than \$1 billion. The median amount spent on logistics by these companies ranged between \$200 million and \$249 million, and 33% of these companies spent \$750 million or more on logistics.

Organization of This Report

We begin this report with “The Keys to Supply Chain Success,” a synopsis of the previous years’ studies on the operations excellence in adaptive supply chains. We then move to the focus of this report, connectivity, which is presented in four major sections. The first section, “Moving Towards a ‘Connected’ Supply Chain,” details current and planned supply chain technologies, including the building blocks of SCEM, and the tools and methods used to manage supply chain and logistics activities.

In the second section, “Defining the Role of Technology in Enabling Connectivity,” we present a model that details the various components that make connectivity possible. In “Reaching the Desired End State,” we describe the components needed for adaptive supply chain execution. The framework



we propose — SCEM — incorporates data and supply chain visibility, exception management, and automated decision making. This framework helps firms anticipate changes in their supply chain, rather than just react to the changes that occur.

The conclusion of this report, “Future Vision: Knowledge Management and Collaboration,” consists of three industry viewpoints — international consulting firm, transportation provider, and software provider — regarding connectivity in the supply chain and the role of technology in achieving that connectivity.

Case studies about Dell Inc., Luxury Cruise Center, Nissan North America, Inc., and Samsung Electronics Co., Ltd., reinforce another finding from our research: Supply chains — not just individual companies — must do the right things, and do them efficiently and effectively, for the betterment of all participants in that supply chain.



The Keys to Supply Chain Success

“The future of manufacturing belongs to ‘connected’ organizations that are able to gather critical information and provide it to the right people in the right format.”

– Charles Johnson, Worldwide Managing Director, Manufacturing Industry Unit at Microsoft.

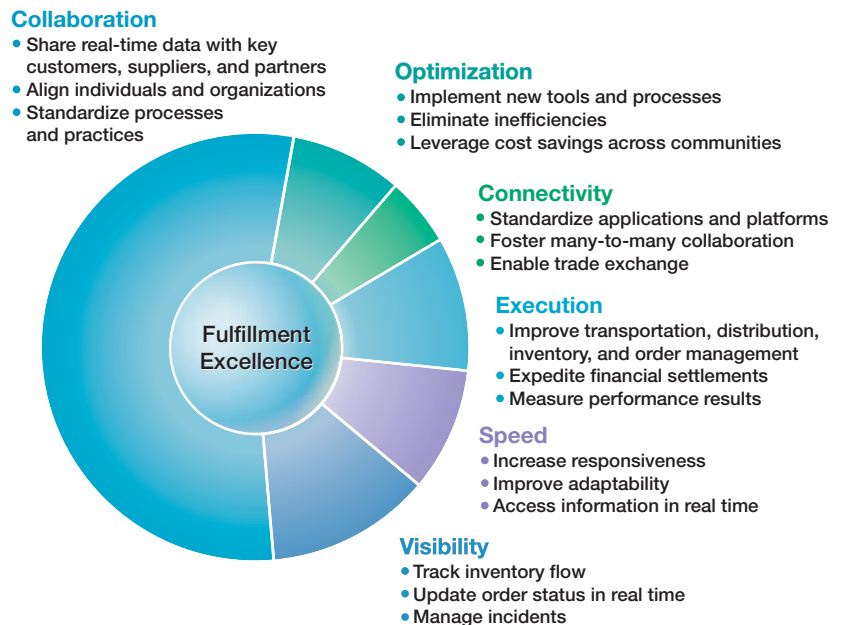
This year’s study on connectivity is the third in a series of annual research efforts to more fully understand the role of key components, what we are calling “drivers,” necessary to achieve logistics and supply chain management (SCM) excellence through an adaptive supply chain: visibility, execution, speed, connectivity, optimization, and collaboration (Figure 1).

Let’s review a bit. In our 2000 report, *Logistics @ Internet Speed*, we introduced the “six drivers of excellence” as the key components of an adaptive supply chain. The 2001 report, *Transforming Logistics: A Roadmap to Fulfillment Excellence*, described a plan, using these six drivers, for moving organizations from a functional perspective of their logistics systems to more collaborative, adaptive networks and supply chains.

Our plan for future research at the end of 2001 was to examine each driver individually to determine its attributes and relationship to the others. This changed when numerous logistics and supply chain professionals asked us to put these drivers in priority. Economic conditions at that time were forcing many firms to ensure that their people, processes, technology, and financial resources were being used to maximum effectiveness. We were asked what driver, when implemented, would accelerate a firm’s implementation of an adaptive supply chain.

That question led us into research that has spanned the past three years. In 2002, *Visibility: Tactical Solutions, Strategic Implications* established data visibility as the leading (or most important) driver for both strategic and operational reasons. The events of September 11, 2001, were a horrific confirmation of that as many firms struggled to locate their products throughout the supply chain and to determine whether those products were in transit or at rest in some storage facility. Beyond these operational aspects, we also found that visibility had profound strategic implications for the entire organization.

Figure 1: Drivers of World-Class Supply Chain Management

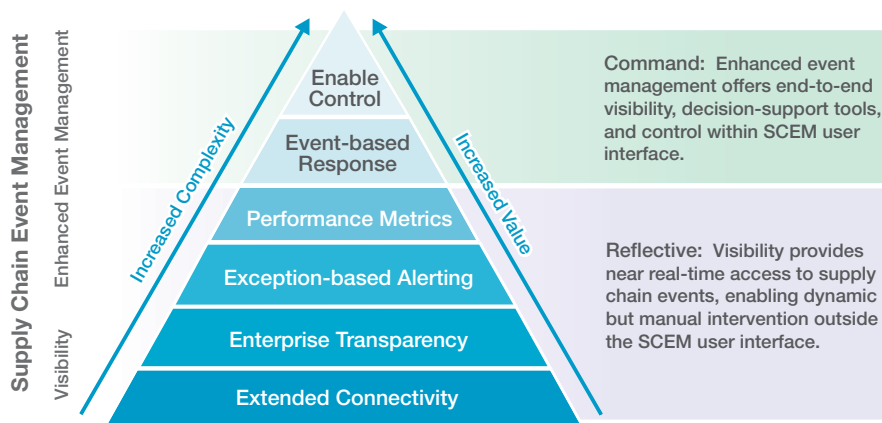


In the 2002 report, we wrote that visibility is the “foundation” of SCEM. Specifically, “it is the glue that binds the total business decision-support and technical processes to integrate the supply chain components, both within the business and with external providers, suppliers, and customers. With this information, both strategic and tactical changes can be made and seen by the entire organization.” Figure 2 shows the building blocks that constitute SCEM.

The surprising part of the 2002 study was that most logistics and supply chain professionals did not initially rank “visibility” as the most important driver in achieving world-class supply chain excellence. Instead, they ranked execution or speed, or both. Once these professionals realized how visibility would help their efforts regarding execution and speed, they without exception agreed that visibility was indeed the accelerator for transforming the organization into an adaptive supply chain participant.

Having the three drivers — visibility, execution, and speed — so closely linked established the need to examine each of them. What we did not know after the 2002 study, however, was the relationship between execution and speed. These drivers were the focus of last year’s study, *Operations Excellence: The Transition from Tactical to Adaptive Supply Chains*. As a result of this research, we now know that these two drivers create a synergistic effect that we are calling “operations excellence.”

Figure 2: The Building Blocks to Supply Chain Event Management



In looking back, the sad truth is that two years after identifying visibility as the most important driver, many firms are still struggling to fully implement it. We now realize that implementing visibility successfully involves more than this one driver. We have discovered that underlying visibility is connectivity. Connectivity is needed to achieve the seamless integration of information coming from multiple supply chain partners. Connectivity creates true supply chain visibility. And connectivity is the focus of this year’s report.

While reflective visibility is the foundation of SCEM, enhanced event management builds on visibility and offers the promise of truly adaptive supply chains through automated exception handling, directed workflows, directed resolution, and overall network/community management.

Moving Towards a “Connected” Supply Chain

“Manufacturers can best achieve connectivity throughout the enterprise and their supply chain by implementing solutions that take advantage of the current, commonly available software systems they already have in place. Leveraging these systems allows manufacturers to easily connect to supply chain partners, enabling a level of communication and collaboration that improves their ability to make informed decisions and stay competitive.”

– Charles Johnson, Worldwide Managing Director, Manufacturing Industry Unit at Microsoft.

Achieving connectivity in the supply chain presents varying degrees of challenges to a firm. In an ideal state, a single, electronic, communications hub would automate the exchange of transactional data between a firm’s business management systems (such as ERP) and the equivalent systems at suppliers, third-party logistics (3PL) providers, and customers. Ideally, connectivity would eliminate the need to maintain multiple connections to supply chain partners. Connectivity, specifically communications, would not depend on the standardization of data or message formats.

Getting to this ideal depends on the firm's ability to fully integrate its own IT (including hardware, software, systems architecture, data distribution, and so on). To better understand the nature of this integration, we asked firms about their IT operations, including database centralization, applications, and hardware/software interfaces for transaction management.

Nearly half of the respondents (48%) said that a centralized system hosts a single database, applications (traditional SCM software, office applications, etc.), and hardware/software interfaces. Another 15% said their organizations use desktop systems to host the software applications, but these applications feed off a separate database server. Another 18% said their IT operations consist of separate applications and database servers. Of particular note are those firms (19%) that, in addition to having separate applications and database servers, operate their supply chain activities over the Internet through an outsourced arrangement (e.g., an application service provider).

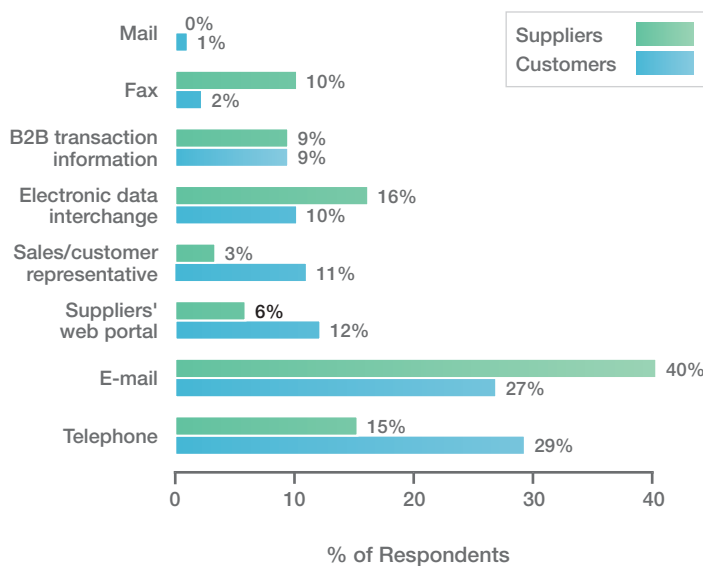
It is common knowledge that a centralized IT environment makes the task of internal and external data exchange faster and easier to accomplish. Connecting (integrating) decentralized internal systems and applications together is possible through a variety of interface technologies. However, the latter IT operation does not easily promote — and sometimes does not even make possible — distributed access to critical supply chain information for suppliers, 3PL providers, and customers, including information about supply chain movements, exceptions, and statuses (such as inventory levels, production capacities, and transportation availability).



Status of Connectivity

A firm’s IT environment for transaction management directly affects how that firm communicates with its suppliers and customers. Given that a little more than half of the respondent firms operate in a “somewhat” to “totally decentralized” environment, it is not surprising that a majority of them communicate with suppliers and customers primarily by e-mail or telephone, or

Figure 3: How Do Users Primarily Communicate Regarding Order Status?



both (Figure 3). Our research also shows that electronic data interchange (EDI) is used just as often as the telephone when communicating with suppliers.

To determine a firm’s effectiveness at connectivity, respondents were asked to rate the visibility of information for eight key supply chain areas:

- Demand forecasts
- Vendor order status
- Inbound shipment status
- Production schedules
- Finished goods inventory at the plant
- Finished goods at the field distribution center (DC)
- Outbound shipment status
- Customer order status

Within a firm’s four walls, information on customer order status and outbound shipments received the highest overall rating in terms of visibility; over 80% of the respondents report that data about these two items is “somewhat” to “highly” visible. Fewer respondents (67%) report this same level of internal visibility for vendor order status and inbound shipments. Only 30% said that information about finished goods inventory at the plant and DCs is “highly” visible.

While we might say these ratings of internal visibility are “good” to “very good,” visibility to this data from outside the firm (external visibility) is not so good. With two exceptions, over 39% of the respondents have either “very limited visibility” or the information they sought is “not available.” The two exceptions are outbound shipment and customer order status; about 60% of the respondents say this information is “somewhat” to “highly” visible.

Timeliness of Data

Connectivity involves more than just visibility of information. The timeliness of information (i.e., real-time or near real-time information) helps get the right products to the right places at the right time. Our study suggests that a great

deal of work remains to be done in this area. Over 60% of the respondents said they update demand forecasts weekly or monthly; over 68% update vendor order status and production schedules daily or weekly; and 54% update inbound shipment status daily. On the other hand, respondents were dutiful about updating information regarding outbound shipment status, customer order status, and finished goods inventory at both the plant and field DC. Over 32% of the respondents receive updated information daily, and another 38% receive updated information in real-time.

Study participants noted that real-time information achieves two significant, direct, and measurable results: improved customer service and improved operating efficiencies. Research on the much noted “bullwhip effect” has confirmed this as well. Multiple studies have shown that better, more timely information will help minimize the variations in supply chain operations and service.

SCM Tools in Use

When it comes to managing transportation and distribution, most firms buy commercially available software applications and systems. This software comes with connectivity (e.g., application programming interfaces) to enable internal and external visibility for SCEM.



case study #1

Dell Inc.

Reverse Logistics Needs Better Connectivity, Too

Dell Inc. (Round Rock, TX) realized its returns and repair process needed reworking. At the time, Dell operated its own customer service department and outsourced all repairs to contract manufacturers. These manufacturers were usually the same vendors that had originally manufactured the parts. When a customer had a component that failed, the customer would call Dell customer service. A customer service representative would diagnose the problem and, if the part needed to be replaced, generate a part release order for the customer. Dell would then ship the replacement part from its fulfillment center to the customer.

On receipt of the part, the customer or a field service engineer would replace the part and return it to Dell. Dell would then ship the defective part back to the contract manufacturer, which would then repair the defective part and ship it yet again to Dell for future customer use.

Although this process worked well for Dell, it was costly for three reasons:

- *High inventory levels.* To meet its service level agreements with customers, Dell had to keep a redundant inventory of service parts at various nodes in its supply chain. Inventory carrying costs and write-offs from technology obsolescence because of short product lifecycles just added to the cost of inventory.
- *Lack of optimized reverse logistics.* Dell received all the defective parts from its customers and was forwarding them to the contract manufacturer.
- *Lack of supply chain visibility.* Inventory was managed in various systems and stored at various supply chain nodes. There was no clear visibility into on-hand inventory at the various warehouses and fulfillment centers. Worse, neither Dell nor its contract manufacturers had any visibility into the spare parts inventory.

The Solution

Dell first focused on logistics by having the contract manufacturers ship replacement parts directly to customers, and having customers send defective parts back to the contract manufacturers directly. This eliminated intermediate nodes in the logistics network and made the returns process truly direct. With spare parts inventory now managed by contract manufacturers, Dell's inventory and logistics costs plummeted.

To manage this process, Dell used enterprise application integration to provide connectivity between it and its contract manufacturers. Dell also leveraged supply chain inventory software so that all stakeholders in the supply chain could monitor and better manage service parts inventory. The result: better collaboration with suppliers, lower support service costs, and end-to-end inventory visibility, which together lowered inventory carrying costs for both Dell and its contract manufacturers.

However, 40% of the respondents primarily use in-house developed software and spreadsheet software to manage their transportation activities, or they manage these manually. About the same percentage of respondents (38%) do the same when managing distribution activities. More disturbing is that over 40% of the respondents said they are not currently planning to implement the following SCM software system and business practices:

- Partner relationship management
- Supplier relationship management (SRM)
- B2B industry standards (e.g., RossettaNet in high tech)
- Radio frequency identification

This list contains two collaboration systems — partner and supplier relationship management — that facilitate the daily operation of business, but do not directly affect the firm's ability to create connectivity and visibility. Nevertheless, the analytics and transaction management provided by these systems are powerful tools in controlling and reducing everyday supply chain-related costs. *Not* implementing these systems will limit a firm's future strategic initiatives toward creating an adaptive supply chain.

Our research shows that size matters. The “giants” (revenues of \$3 billion or more) more aggressively implement CRM, order fulfillment, vendor management inventory, and WMS than smaller firms.

This difference in IT implementation often comes down to money. Take EDI for example. When EDI became mainstream in the late 1980s and early 1990s, it was touted as the solution for seamlessly moving data between trading partners. Users soon realized that EDI required an extensive infrastructure — EDI standards, translation capabilities, and a network — which made it too expensive for most medium- and small-sized firms to even consider at that time. EDI adoption, as we now see, was somewhat limited by the required investment.

Sadly, not a lot has changed with respect to the cost of technology and a firm's ability to find the funds to acquire it. Respondents cited budget as the primary obstacle affecting IT spending for SCM. Further complicating this is a firm's ability to precisely quantify the expected return(s) for the investment. This complication leads to the second-highest barrier to spending reported by study participants: Before companies invest in SCM technology, many need to reengineer key business processes. Without this reengineering (or assessing the current sufficiency of processes), investing in IT alone will not bring the anticipated returns.



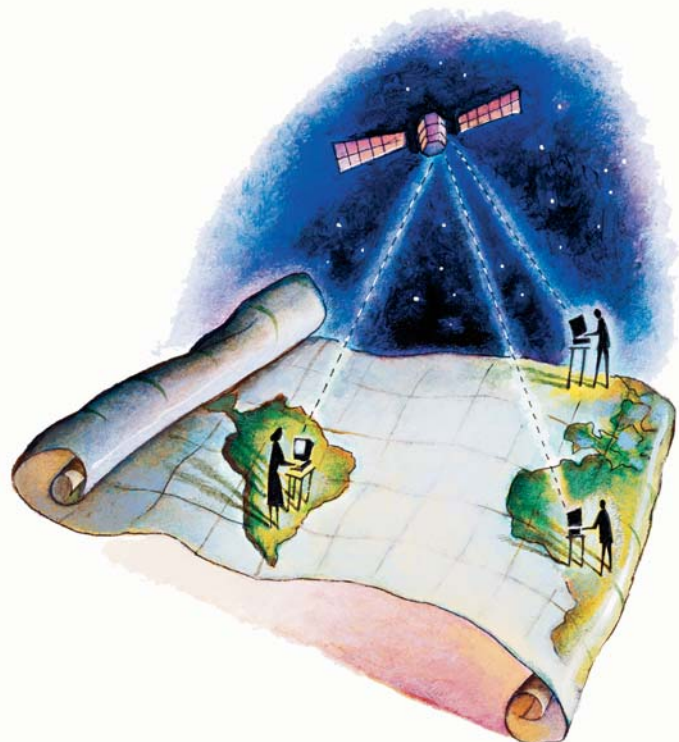
Figure 4: Top Five Investments in Supply Chain Technology for 2005



So, firms are being scrupulous about getting more “bang” for their IT bucks. This strategy can be seen in the IT investments firms plan to make in 2005. Figure 4 shows that these investments will span all aspects of SCM — from centralized business management systems (such as ERP) to specific functional activities (such as WMS).

The top two areas for investments in technology — CRM and Demand Planning — reflect the current struggle manufacturers in the supply chain are facing. While no position in the supply chain is without complexity and problems, manufacturers especially seem to be dealing with market pressures that require them to be flexible and adaptive — and to collaborate with their supply chain partners in order to survive and grow.

Unfortunately, traditional SCM technologies tend to focus on transactional data; they are ill equipped to give a firm a better understanding of its customers with regard to quality and service levels. That is, traditional SCM technologies were not designed to deliver the insight and information needed to link supply with demand. Thus the struggle. The priority on investments in CRM and demand planning signals that many firms want technologies that will help them build supply chains that can respond more quickly to market and customer demands.



Defining the Role of Technology in Enabling Connectivity

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With a close eye on cost containment and reinvesting in product development, companies have not installed ERP or the associated bolt-on applications that provide additional supply chain functionality. This lack of technology presents many issues to these companies: lack of information to improve logistics performance and legacy systems that are difficult to integrate with are just a couple examples.

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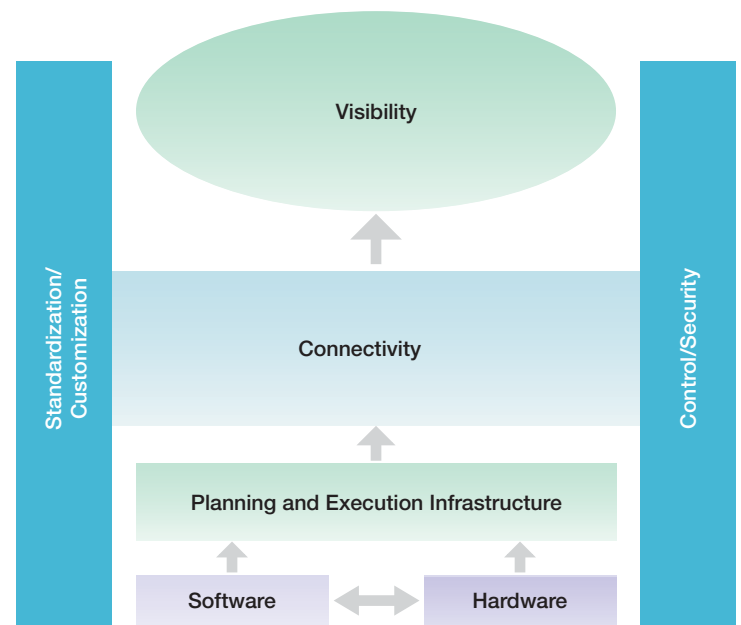
– Bill Kammerer, Vice President of Logistics for CRST Logistics, Inc.

So far, we have essentially addressed connectivity in terms of IT — hardware and software. Generally, IT has been the responsibility of the IT department. That’s changing. Logistics and supply chain professionals are taking a more active part in decisions regarding hardware and software, and with peripheral issues concerning SCM (Figure 5). These issues include data control and security, data and systems standardization and customization, and systems integration (within the firm’s IT and its connectivity to the supply chain). Decisions made in these areas will affect a firm’s planning and execution infrastructure and, by extension, the firm’s visibility into the supply chain. For these reasons, IT is too important to be left solely to IT. IT decisions in the future need to be made jointly — IT with logistics and supply chain professionals — to ensure that the firm’s planning and execution infrastructure will support the firm’s desired level of operational excellence — both now and in the future.

What Figure 5 does not show is that the planning and execution infrastructure consists of inventory, order, transportation, and warehouse management systems, to name a few SCM tools. All together, the fully integrated planning and execution infrastructure is the engine running the firm. It determines the firm’s capability to digest and distribute increasing amounts of data. Such data throughput can be a serious bottleneck because any management decisions the firm makes regarding daily operations and SCM are through this infrastructure.

The planning and execution infrastructure must address the firm’s business and SCM processes. This will not be easy. Traditional enterprise applications in the planning and execution infrastructure were designed to support internal processes; they were not designed to choreograph external operational requirements so that product data and change notifications from the supply

Figure 5: Information Technology Issues in Supply Chain Management



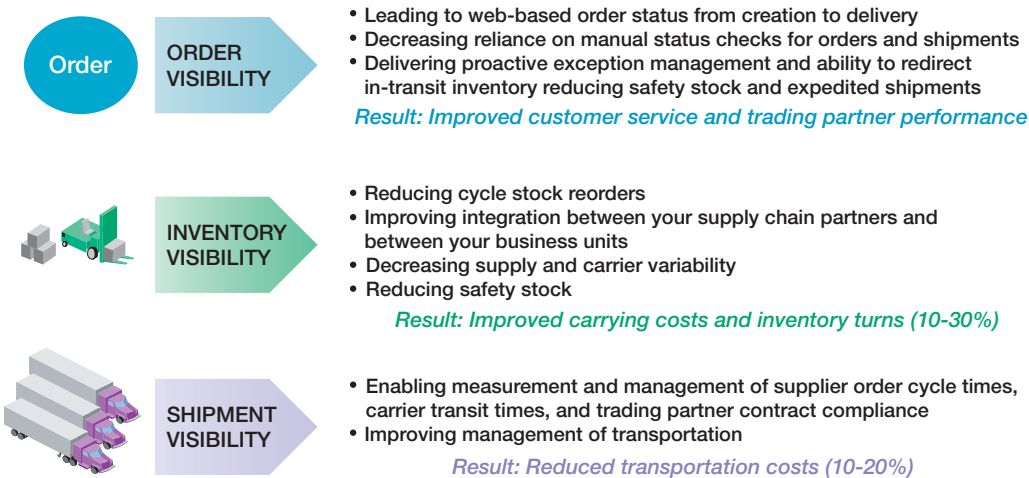
chain can be easily accepted internally. Therefore, we need to present this caution: Supply chain partners must be diligent in ensuring that each of their planning and execution infrastructures support a greater, adaptive platform that will foster trade exchange — irrespective of hardware and software. That is, no supply chain partner should be forced to implement a particular vendor's product or service offerings.

For this to happen, data standardization is key. Data standardization creates a single format that can be used throughout the supply chain, as well as reduce costs and IT complexity, and increase visibility. Not surprisingly, as supply chains become more global, the need for open, broad-based standards has grown. So have the pressures on firms to try to differentiate themselves. (This applies both to user firms and to SCM vendors and 3PL providers.) Thus, the decision to adopt standardized IT or to customize IT must be balanced with each firm's unique business processes.

The work needed to create connectivity can overwhelm most firms. Given the lack of progress to date toward the goal of seamlessly connecting supply chain partners, the effort must indeed be formidable. This should not, however, keep firms from pressing forward in this quest. The reason we say this is simple: Connectivity is the enabler of visibility. The benefits that a firm and its supply

chain partners can realize by creating true visibility are worth the arduous journey (Figure 6).

Figure 6: The Benefits of True Visibility in the Adaptive Supply Chain



Reaching the Desired End State

“ We have been surprised that so many people have yet to put the ‘end game’ on their radars regarding the potential huge influx of data from RFID and the speed of data from web-based connectivity. We strongly believe that planning now on how you can ‘turn the data into action’ is a strategic imperative that people must address before the tsunami of data overwhelms them. ”

– Tony Ross, Senior Manager, Capgemini U.S. LLC

Much of this report has focused on two drivers: visibility and connectivity. In fact, these two drivers were very much the focus of our discussion about Figure 5. However, in that discussion, two critical topics were not examined in detail. Data collection and data synchronization are the two *strategic* pillars that support the planning and execution infrastructure, and by extension the adaptive supply chain itself.

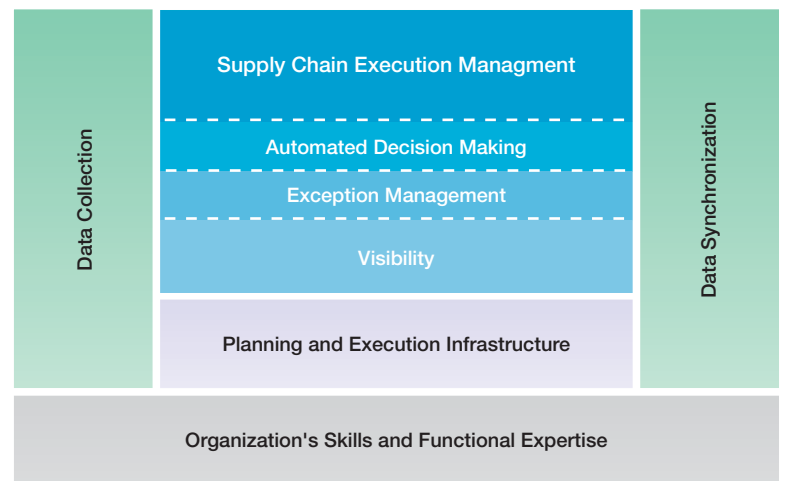
In this section, we pinpoint two technologies that provide the *tactical* means to implementing visibility and connectivity. Despite all the press in the marketplace about them, these two technologies seem to be off the radar screen for a large percentage of firms. But not the “giants.” The two technologies: RFID and exception management.

Advancing Toward SCEM

Figure 7 shows a progression toward reaching the desired adaptive supply chain — how a firm can turn data into action. This progression builds on a firm’s most important strategic elements in achieving an adaptive state — its people (specifically, their skills and functional expertise). To move to the next level toward the adaptive supply chain, people must be supported by the planning and execution infrastructure discussed in the previous section. Caution: The willingness of people to change is critical, their ability to be flexible and adaptive is required, and their capability to understand and use new technologies is mandatory.

The top-most level, in Figure 7, is SCEM, which is composed of visibility, exception management, and automated decision making. SCEM is the end state, the goal; it enables a firm to dynamically respond and plan (or re-plan) in real-time.

Figure 7: Getting to Supply Chain Execution Management (SCEM)



case study #2

Nissan North America, Inc.

Connectivity Into Supply Chain Events is Key

Nissan North America, Inc. (Gardena, CA) embarked on an aggressive campaign to grow market share in the Americas by introducing ten new automotive models in a very short time. The new vehicles, plus current market penetration, dramatically increased the number of spare parts. This could not be ignored. Part of Nissan's strategy for profitable growth included meeting its dealer needs for spare parts and enhancing customer satisfaction by improving supplier delivery performance.

Doing that involved over 400 North American suppliers, plus a large quantity of parts from Nissan's parent company in Japan. Except for a few parts shipped to dealers, all parts are routed through Nissan's warehouses across the U.S. However, there were problems. Low spare parts service levels caused dealers to purchase non-Nissan parts. Plus, the low fill rates for parts caused dealers to lose revenue as customers went to other outlets for parts and repairs. In addition, Nissan lacked visibility across the supply chain as to what was purchased and arriving from its Japanese suppliers, the status of those orders and shipments, and where parts were in-transit. This lack of visibility increased the number of expedited shipments, which were too often unnecessary. Last, Nissan had no technology in place to accurately measure supplier performance.

The Solution

Nissan needed a single system for performance monitoring and order-shipment exception alerting within the spare parts network of its part suppliers. Such a system would help in both day-to-day order and shipment management and tracking, and in strategic supplier performance monitoring; namely:

- Reduce service parts inventory level while increasing customer satisfaction,
- Optimize and reduce transportation costs,
- Enable real-time visibility with suppliers domestically and internationally,
- Provide exception management and alert Nissan or the supplier to take corrective action when out-of-tolerance events occur, and
- Monitor supplier performance.

The SCEM system Nissan installed provided exactly that. The system's visibility helps Nissan and its suppliers resolve exceptions before they cause significant problems downstream. This visibility also helps users focus their attention on the orders and shipments that could most affect the entire supply chain. SCEM also gives Nissan the ability to monitor suppliers and present them with monthly performance metrics through a supplier portal.

Together, visibility along the supply chain and into both exception reporting and supplier performance gives Nissan the core information to give more accurate parts arrival times to dealers and to increase customer service, all while decreasing inventory levels and associated costs.

Data Sources

We believe a supply chain consists of about 60 data sources (Figure 8). When this data is collected, integrated, and presented as information, it transforms the logistics functions from post-event analysis to a real-time adaptive supply chain.

Visibility into these data sources exists at various levels. At the most basic level, and for the most part, visibility has been limited internally to executive management at the business unit level. The scope of this visibility is not sufficient for evolving to a fully adaptive supply chain state. Visibility, through connectivity, must extend across the enterprise and onwards to suppliers, 3PL providers, and customers.

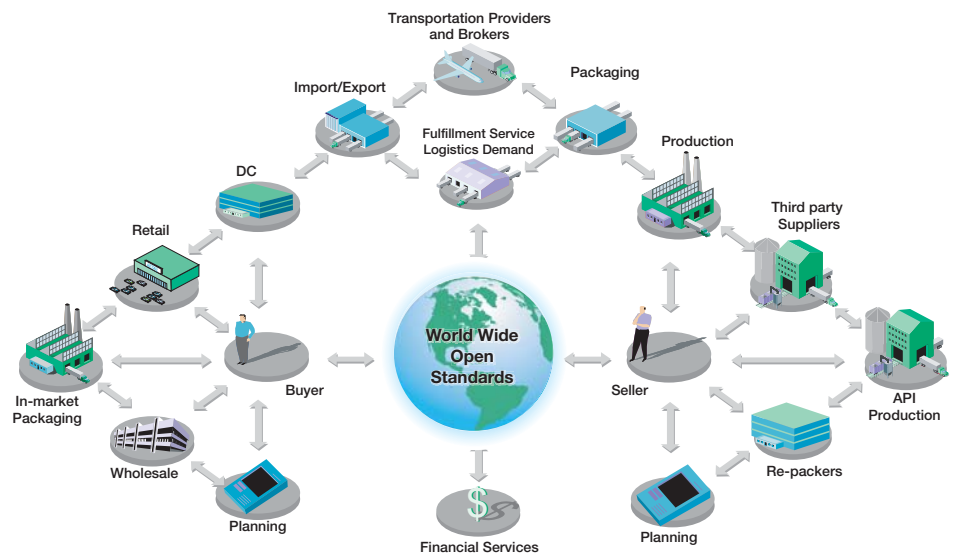
Technology exists to generate and use data, and therefore create visibility in the supply chain. So, why are there few fully adaptive supply chains? One of the primary reasons is because data collection does not exist in a vacuum. Data “cleanliness,” accuracy, and availability are also required, but these become exponentially more difficult to facilitate — and exponentially more costly to ensure — as the sophistication of decision making (and the need for data) increases. Just synchronizing the data between a laptop and a desktop is time consuming; working with 60 data sources in the supply chain is enormous. Consider just one of those data sources: Large consumer package goods companies ship billions of units each year, and those units often have three to four SKU numbers and descriptions as they travel through the supply chain.

In addition to data cleanliness and accuracy, technologies have unique data requirements to identify items and transactions. (RFID, for example, needs unique ways to identify items while they are in motion and at rest in the supply chain.) Standardization will facilitate the exchange of this data, as well as help ensure data accuracy and lower implementation costs for supply chain partners.

Radio Frequency Identification

Barcode and point-of-sale transactions, as well as other types of order fulfillment data, have been exchanged across value-added networks for quite some time now. Despite this, many firms have not taken advantage of these data-rich technologies to improve their planning and execution, or to enhance supply chain visibility. Now a new technology promising to be the next-generation in data collection is on the horizon: RFID. Middleware currently

Figure 8: Data Sources in the Supply Chain



exists to support RFID data flowing into legacy IT systems. Software also exists to filter RFID data into the planning and execution infrastructure. Some ERP and WMS packages already support RFID.

RFID has the potential to improve supply chain planning and execution. How we collect supply chain data and then use this data will change how we visualize supply chains — with the proviso that the supply chain data is accurately and efficiently collected.

Exception Management

The key to efficient and effective product flow (or movement) is the elimination of events that interrupt that flow. A mechanism that can provide alternative solutions/options, and the ability to know what those options are, is an invaluable tool.

Exception management is that tool. Exception management monitors transactions and events identified through visibility and provides firms with the opportunity to dynamically anticipate, respond, and adapt to events, rather than be purely reactive to those events. By extension, creating the real-time adaptive supply chain requires automated decision making (or “enabled control”) exists. Such functionality is characterized by “selected exceptions” that will be handled automatically within the system by intelligent decision-making tools (e.g., adaptive agents that encapsulate key business rules and that may even “learn” from recent exceptions/events).

In Closing

While it is simple for us, the authors of this study, to recommend significant transformational efforts through connectivity to the supply chain, we know the following to be true:

- Visibility within firms has not yet matured.
- Visibility does not occur in a vacuum.
- End-to-end visibility is the desired end state of an adaptive supply chain.

All we can do is offer tools of understanding. To start, there are the basics, the six drivers in adaptive supply chains: visibility, execution, speed, connectivity, optimization, and collaboration. These drivers help create the logical progression of steps leading to an idealized SCEM. Throughout this report and in the point-of-views that follow, we have identified some of the future tactical and strategic directions in supply chain technology. We sincerely hope this entire package helps you prepare for the ongoing challenges you face in conducting business — and in your efforts for connectivity in the adaptive supply chain.

Future Vision: Knowledge Management & Collaboration

The Capgemini Perspective: “Show Me the Data!”

“Show me the money,” an exclamation from a Tom Cruise movie, is the subtext behind any discussions about adaptive supply chains. Today more than ever and in the future, data is the “currency of exchange” between supply chain participants, and money is in the data. As we have found in previous studies, the ability to move from a static, rigid supply chain to a flexible, adaptive supply chain can only be accomplished through the access, availability, and accuracy of data. This can only be done through true connectivity.

In logistics and fulfillment, you are only as good as your last order fulfillment metric. This is true regardless of whether you provide raw materials to manufacturers, ship manufactured products to distributors, or provide finished goods to an end-user channel. In each case, the increased demands for you to improve your fulfillment process will only be met through improved connectivity.

Data — through seamless connectivity — is required to address such key business issues as compliance, cost reduction, strategy, and business transformation. Every sector, every industry, is dealing with these issues, whether because of government regulations, “gorillas” in the marketplace, or the survival instinct that requires having an adaptive, customer-responsive supply chain. The wild card in all this is the alignment, accuracy, and standardization of data, a.k.a., global data synchronization (GDS). The volume of data that will begin to flow from tracking RFID “tagged” pallets, cases, and eventually pieces will make GDS a requirement, not an option.

At Capgemini, we see that the ability to be connected to the supply chain and having the necessary data flows between you and your supply chain partners depends on a foundation of strong planning and execution tools. As you move from tactical tools, to event management tools that enable you to anticipate supply chain perturbations, to tools that provide for automated decision making, the ability for these tools to be true enablers is totally dependent on the data acquired through both internal and external connectivity.

The future vision of this connectivity will be focused around the seamless merging of data from CRM, SCM, and the broad variety of technologies and processes for harvesting and analyzing specific data to make sound business decisions (generally called business intelligence, BI). Because the money is in order fulfillment, the data within SCM that satisfies order fulfillment will come from demand/planning systems (available-to-promise and capacity-to-promise) and



case study #3

Samsung Electronics Co., Ltd.

A Supply Chain Portal Pays Back in Four Months

Korean-based Samsung Electronics Co., Ltd. maintains facilities around the world, including 24 production subsidiaries, 26 sales subsidiaries, and 20 branch offices. Plus, it outsources manufacturing and distribution to local business partners.

Back in 2000, the company deployed ERP to cover all of these affiliates. As part of the implementation, Samsung's international sales subsidiaries relied on point-to-point technology for purchasing products from headquarters and regional production subsidiaries, and for information about product distribution. A parallel system was used for exchanging information with key customers. Unfortunately, the two systems did not fully meet Samsung's needs. So, the company used a patchwork of e-mail messaging, telephone, fax, and other communications methods, but these created time lags and other problems.

The Solution

Samsung turned to Microsoft for help. Together, the two companies built the Global Samsung Business Network (GSBN), a worldwide collaborative portal system. GSBN lets Samsung and its overseas subsidiaries, partners, and customers have a real-time view of the status of purchase orders, sales, shipping, and inventory.

The portal includes two areas: a customer collaboration area and a business area for internal audiences (such as subsidiaries). Each area is connected to back-end business processes and includes variations on four "megaprocesses": distribution of information about product offerings, inventory planning, order fulfillment and payment, and service and support.

The portal is based on Microsoft integrated server software, all running on the Microsoft Windows Server 2003 operating system. The portal's operations data is maintained on the back end by SAP R/3 ERP software. Microsoft BizTalk Server acts as the intermediary between SAP and the portal systems, and coordinates pricing information unique to each customer and region. Microsoft Content Management Server manages content information, such as product catalog and showroom areas. Microsoft Commerce Server and web services give business partners and customers access to the portal. Web services, and integration with Microsoft Excel, let smaller businesses without sophisticated IT interact with GSBN. Last, GSBN exploits Microsoft multilingual support; users can easily conduct transactions and access information and product brochures in their own language.

The new portal gives Samsung, its subsidiaries, and its partners faster and fuller access to real-time data for decision making. Access to inventory and sales data and projections is greater, deeper, and more accurate. Customers are kept informed about how product availability compares to their weekly demand forecasts, resulting in better customer satisfaction. The system also provides a one-stop source of information, such as product arrival date, marketing cost analysis, customs service, and banking. And because the portal was developed quickly and economically, and runs with relatively minor operational support costs, it contributes to IT's reduced total cost of ownership on an ongoing basis.

Samsung expects the portal's direct benefits from additional profits, reduced sales costs, and reduced site development costs will amount to US\$1.3 million per year. Indirect benefits from enhanced demand forecasting, reduced inventory costs, and enhanced delivery forecasting are expected to total US\$1.6 million per year, for a combined annual benefit estimated at US\$2.9 million. With an annual return on investment of 235%, Samsung expects the payback on this investment to take about four months.

from distribution/logistics; the data within CRM for order fulfillment will come from sales planning and service performance; and the data within BI for order fulfillment will come from shared portals, data storage, shared dashboards, and a truly collaborative BI environment. These areas combined will be the enablers to help you move your static enterprise to one that is adaptive and connected — and to where both the data and the money are.

The CRST Logistics Perspective: Transportation Management Systems

Transportation Management Systems (TMS) is a term that conjures up many thoughts from small- to mid-sized companies (revenues below \$1 billion). Some see TMS as a panacea — a solution that will solve all of their transportation needs. They see TMS as the tool that will bring their traffic operations into the twentieth century, immediately transforming them into world-class transportation departments. Others see TMS as a term synonymous with large capital investments and an endless professional-services implementation.

Let's step back a bit. The issues companies face that have an affect on logistics are:

- ❑ *Increasing logistics costs.* For example, the strong economy and tightening capacity of freight haulers has pushed costs up between 10% to 15%.
- ❑ *Increasing pressure of collaborative relationships.* This pressure comes from such programs as just-in-time, vendor managed inventory, and scan-based trading.
- ❑ *Limited visibility into their supply chain.* Visibility into the supply chain is critical for decision making in sourcing, fulfillment, and other key supply chain activities.
- ❑ *Limited professional logistics management experience.* Many purchasing and manufacturing professionals responsible for the movement of raw materials and finished product are not yet managing logistics with a “Supply Chain Eye.”
- ❑ *Lack of current technology and limited technology budgets.* On the one hand, the road to world-class operations is not through a lack of information to improve logistics performance, nor from legacy systems that are difficult to integrate. On the other hand, investing scarce resources into non-core competency functions is a very difficult sell to management.

Can TMS help here? Panacea — a TMS is not! A TMS is particularly successful at solving cost containment, collaborative partnerships, and visibility issues. A TMS can support cost containment through shipment optimization, carrier contract management, and communication with carriers and vendors. A TMS addresses collaborative relationships by enabling communication and data

case study #4

Luxury Cruise Center

Redefining Connectivity in the Industry

Offering the “latest and greatest” fares available to clients in the fastest manner possible is the name of the game in the cruise industry. Behind the scenes, cruise lines distribute daily electronic feeds that detail short-lived promotions, including cabin allocations, special sales, and future price reductions. These feeds provide the “latest picture” of all sailing ships and their itineraries. Each line projects profit or loss for each sailing itinerary by the number of cabins sold or shore excursions purchased. Needless to say, both cruise lines and travel agencies “feed” on these feeds.

The cruise lines used to fax these promotions to select agencies because they had no way to electronically transmit the files, nor did the agencies have a way to accept the files electronically. In many instances, faxed feeds were received days after valid pricing expired, rendering the feeds useless.

One cruise broker opted for a different approach — one that would obtain real-time feeds and use them profitably.

The Solution

Luxury Cruise Center (LCC; Miramar, FL), launched in July 2002, purchases blocks of rooms for popular cruises worldwide. It then markets the itineraries by direct mail, e-mail, and telemarketing. LCC realized that if it could obtain, decipher, and convert the electronic feeds directly from the cruise lines into marketing campaigns, then it would become a premier cruise agency. LCC worked with several cruise lines to learn how the feeds were generated and transmitted. It then determined how to receive these feeds in a timely way and make them into real-time marketing strategies.

LCC is now 80% toward its goal of connectivity with the cruise lines. Reaching 100% is proving difficult because the cruise lines overhaul their personnel, software, and hardware every eighteen months. In some instances, entire systems are scrapped in favor of one that has the “potential of saving the cruise line millions of dollars.” Unfortunately, those potential savings often evaporate with each new software release or hardware interface. To alleviate this, LCC reengineered its software to accommodate the cruise line’s IT operations, and LCC uses “open” software when it can.

LCC now has short-lived promotions available to clients within a couple of hours of receiving the feeds from the cruise lines. LCC’s inbound call volume increased 20%; its call-to-booking ratio increased 12%. Within a month of implementing the live feeds, LCC’s monthly revenues increased 30%. The company anticipates that after the first year, it will have exceeded its business goals by 200%, and it is projecting annual revenue increases of 30% or more for the next three years. One last metric: In a list of the fastest growing cruise/travel agencies in the country, LCC has moved from 100th place to 15th in two years.

sharing between business partners. Last, a TMS can provide alerts and monitoring capabilities for various supply chain events.

But for the last two issues on our list, one solution gaining momentum among small- and mid-sized companies is the partnering with a logistics service provider. These providers, such as CRST Logistics, can offer leading-edge technologies for logistics that companies could not otherwise afford. For instance, we can manage a company's complete outsourcing of logistics. At the other end of the spectrum, powered by our G-Log TMS package, we can tailor a logistics solution to the requirements of a client company wanting to keep some or all of its logistics operations in house.

The take-away here is that companies have a variety of avenues open to them in their quest to create a world-class transportation department. These avenues let companies focus on their core competencies and develop strategies to address the cost containment, collaborative relationship, and supply chain visibility issues, while minimizing the effects of cost, technology, and limited professional logistics management experience.

The Microsoft Perspective: Connectivity in the Supply Chain

To respond to industry changes in real-time — including new competitors, standards, and markets — today's manufacturers can not afford *not* to be connected across the enterprise. To be truly successful, today's manufacturers must also connect to suppliers, thereby sharing the critical information needed to meet and exceed market demands. Moreover, companies must be in constant, real-time communication throughout their organization and with their partners and customers.

Simply put, all of this connectivity starts in the enterprise and extends to trading partners and customers. The goal: Enable connectivity to optimize the supply chain.

Unfortunately, some companies are hindered in this effort because of the numerous technology systems throughout their organization, most of which do not talk to each other. Similarly, company departments separated by geography, organizational barriers, and IT that does not speak the same language hamper connectivity. In trying to balance the desire to control costs and achieve operating efficiency, most companies are not able to spend what they believe is required to replace their legacy systems with updated technology.

However, not being able to send, receive, and share information across the company is a hazard they cannot ignore. Manufacturers need to reach a “connected” state, while letting IT organizations generate greater returns on the assets they already have in place.

One way to do this is by leveraging existing technology, implementing technologies and solutions that easily integrate with existing technology, and using new tools to improve connectivity. For example, Microsoft .NET helps

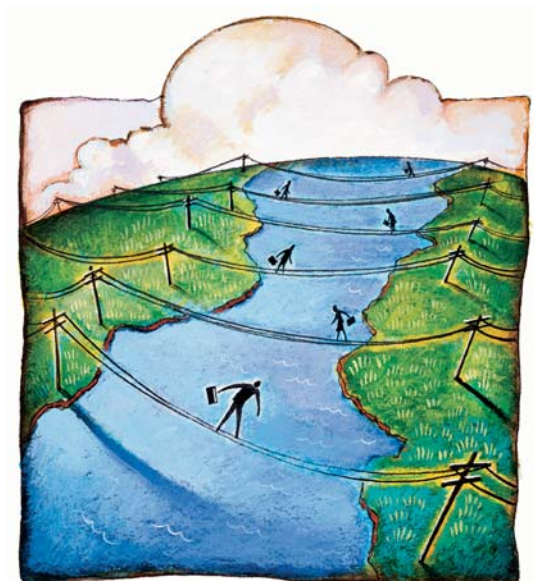


create the level of connectivity manufacturers need. It does this by using XML Web services to expose, share, and integrate data on server and client products — including legacy systems.

The resulting connected organization will enjoy significant business benefits, the greatest being a competitive advantage. By connecting to the supply chain, manufacturers can access the information required to make better, faster decisions, which leads to efficiency gains and a faster time-to-market. It also streamlines transactions with suppliers, thereby reaping the benefits of reduced costs, improved inventory, increased visibility, and the ability to react to demand changes. Being connected to partners helps let manufacturers quickly identify and capture new opportunities.

Equally important, connectivity to customers lets manufacturers provide more information to those customers and respond more quickly to their needs. Among the primary Microsoft tools for integrating with customers is Microsoft's SharePoint Portal Server. This technology creates web portals with integrated document management services and search capabilities. It helps feed real-time data into partner and customer web sites so customers can be served with the latest product information and messaging. Using portals to organize, access, and share data internally as well as externally helps with e-commerce and customer relationships.

Here in Microsoft, we firmly believe that manufacturing companies that understand the relationships between technology, supply chain connectivity, and the power of their entire value chain will be the winners in the competitive landscapes to come.



About the Participants

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Dr. Holcomb is an Associate Professor of Logistics & Transportation in the College of Business Administration at The University of Tennessee, Knoxville. Dr. Holcomb holds B.S., M.B.A., and Ph.D. degrees from The University of Tennessee. Her research interests focus on two related areas of strategic logistics and supply chain management: process design and metrics. Her professional career involved eighteen years at the Oak Ridge National Laboratory in transportation research and policy issues for the U.S. Department of Energy, U.S. Department of Transportation, and the U.S. Department of Defense. Dr. Holcomb's background also consists of varied industry experience with Milliken & Company, the former Burlington Northern Railroad, General Motors, and two years of collaborative research with Procter & Gamble.

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Mr. Fugate is a doctoral candidate in logistics and marketing in the College of Business at The University of Tennessee. His primary research interests are in the application of market intelligence, strategy, and supply chain coordination to logistics. Before pursuing a Ph.D., Mr. Fugate worked in supplier development and worldwide logistics at John Deere after working as an industrial engineer at Allied Signal and Delta Airlines.

The University of Tennessee

The internationally recognized logistics program at The University of Tennessee, Knoxville, is one of the most comprehensive and contemporary programs in the nation. This university is a major research entity. The faculty publishes widely on topics of current industry concern and explores future trends through research and studies. The university has been ranked as the top school in the country for educating logistics/distribution managers, and its logistics program has been ranked as the best of its kind in the U.S.

Tony J. Ross

Mr. Ross is a Senior Manager with Capgemini and is the Logistics & Fulfillment Solutions Sales Leader for the Americas. He has participated in the last three years of the "Trends in Logistics & Fulfillment" study. He has recently managed large-scale projects at both a global pharmaceutical company and a global retailer. He has been interviewed and quoted in periodicals such as *Supply Chain Management Review*, *Inbound Logistics*, *Transportation & Distribution*, and *Logistics Management*. He has over 28 years of combined experience in corporate SCM management and consulting. He has presented at numerous conferences including Council of Logistics Management, WERC, and Georgia Tech Logistics Institute. He has held management positions in distribution, engineering, sales, and consulting.

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