

# Columbus Electronic Freight Management Evaluation

Achieving Business Benefits with EFM Technologies



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# **Columbus Electronic Freight Management Evaluation**

## **Achieving Business Benefits with EFM Technologies**

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## INTRODUCTION

Freight transportation is big business: it consumed 10.1 % of US GDP and about 60% of total logistics costs in 2007. Financially, transportation accounted for about \$848 billion of the \$1.357 trillion spent for total logistics.<sup>1</sup>

Although freight traffic has dropped as a result of the worldwide recession and previous traffic forecasts for 2020 are being scaled back, freight volume growth will still increase the stress on the US transportation network. This stress is likely to continue and traditional investments in port, terminal, highway and rail infrastructure will likely continue to struggle to keep up.

Effective innovation in information technology (IT) may be the most important tool for the private and public sectors to respond to capacity constraints and congestion. Both sectors have been investigating and implementing new IT applications to help manage freight transportation, improve supply chain management, enhance productivity and mitigate congestion; that is the essence of applying Intelligent Transportation Systems (ITS) to freight transportation.

With that in mind USDOT worked closely with the freight industry through a collaborative body called the Intermodal Freight Technology Working Group (IFTWG), operating as a committee within the Intermodal Association of North America (IANA). Together the USDOT and industry helped develop the Electronic Freight Management (EFM) initiative to address data-related problems inherent in complex supply chains with simultaneous connectivity needed among multiple partners. Many-to-many data relationships are a key characteristic of EFM, and hopefully will help advance the state-of-the-art to replace the more costly and incomplete one-to-one relationships that now exist. EFM has already provided strong evidence that it enables significant improvements in supply chain visibility, productivity and effectiveness through simultaneous data sharing. In fact, the USDOT Research and Innovative Technology Administration (RITA) and Federal Highway Administration (FHWA) have identified EFM as a major initiative because its success would reach beyond freight system efficiencies to help mitigate congestion and support growing freight transportation.

## THE ROLE OF THE EFM PROGRAM

A crucial role for IT is providing status information about supply chain events – improving supply chain visibility. Over the last decade, USDOT and the public-private IFTWG have done important work related to improving visibility of freight transportation operations.

That freight community learned that complex, intertwined global supply chains contribute two challenges for IT in improving supply chain visibility: first, a mix of one-to-one, one-to-many and many-to-many data transfer needs; and second, the need to exchange and translate information in multiple formats, including crude forms such as email. Uneven communications among supply chain partners often degrades data quality—its accuracy, timeliness and completeness. Poor data quality increases operating costs and can disrupt shipments with

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<sup>1</sup> Council of Supply Chain Management Professionals, *19<sup>th</sup> Annual State of Logistics Report*, June 18, 2008  
[www.cscmp.org/memberonly/state.asp](http://www.cscmp.org/memberonly/state.asp) Available to CSCMP members for free or to non-members for \$395.

delays and lost goods. Happily, the converse is also true: improved data quality enhances efficiency and supply chain agility in responding to fuel and other economic impacts.

Acting on these accumulated lessons, USDOT's ITS program created the EFM initiative. EFM approaches freight transportation and supply chain issues from the demand-side, enabling benefits of supply chain visibility improvements for the shippers that are freight transportation's customers.

#### USDOT's EFM Program

- ◆ Promotes and evaluates innovative e-business concepts, enabling process coordination and information sharing for supply chain freight partners through public-private collaboration.
- ◆ Non-proprietary open network architectural specification using Universal Business Language (UBL) standards, publicly-available web services, and a Service-Oriented Architecture (SOA) to support business process coordination and secure real-time data exchange specific to the freight transportation industry (called the Freight Information Highway or FIH).
- ◆ A successful 2007 deployment test in Columbus (CEFM), which implemented FIH components and 21 web services to support a Limited Brands (LB) international truck-air-truck supply chain.

## THE CENTRALITY OF SUPPLY CHAIN VISIBILITY

The notion of "supply chain visibility" has drawn increasing attention from all public and private sectors as a means of improving supply chain efficiency. The scope of poor supply chain visibility has been well documented by survey organizations such as Capgemini, Aberdeen Group, and others over the last 5 years. Some of the research, particularly by MIT and Stanford, focuses on using improved supply chain visibility to mitigate supply chain disruptions and unanticipated events. These studies agree that either poor data quality or poor data sharing can delay shipments, disrupt assembly lines, and stress inventories.

Visibility remains such a problem in large part because in a global supply chain environment, there are many supply chain partners that must connect to provide timely, accurate and complete data. However, even one-to-one exchanges fall short on data quality. In a 2007 Aberdeen survey, only 13% of firms reported being satisfied with the efficiency of their supply chain event data collection.<sup>2</sup> The sheer number of supply chain partners and the requirements for collaboration are key elements of the problem. As we noted earlier, the two important challenges which can impede the achievement of supply chain visibility are the mix of data transfer needs and the multiple

#### Importance of Industry Surveys

Numerous industry surveys provide a wide view of industry's opinion of the problem and the scope of current solutions.

- ◆ Aberdeen conducts numerous surveys each related to supply chain visibility. Their surveys typically represent about 350 respondents.
- ◆ Capgemini and two university participants conduct an annual survey that had 1069 respondents in 2008.
- ◆ Logistics Management conducts annual survey of supply chain software use with 422 responses in the 2008 survey.

<sup>2</sup> Aberdeen Research Group, "A View from Above: Global Supply Chain Visibility in a World Gone Flat," [www.aberdeen.com](http://www.aberdeen.com), September 2007. This report was updated in September 2008.

format translations so often required. Another important reason visibility remains a problem is data timeliness. Fewer than 25% of companies have daily or more frequent visibility data. In Capgemini's 2006 survey, almost one-third of companies said they used email as their primary means of data exchange with partners.<sup>3</sup> *EFM technologies can help with all of these actions.*

Capturing high quality supply chain visibility data is a critical challenge, but it is not sufficient to fix visibility problems. Industry literature and our own analysis lead to an important conclusion: visibility itself isn't enough; information must become actionable intelligence and companies must *use the intelligence to improve operations*. As Aberdeen pointed out, financial value comes from *using* visibility information to identify and eliminate causes of delay and other supply chain issues.<sup>4</sup>

Industry studies help explain the size of the data quality problem, for example:

- Data quality problems cost US industry \$600 billion per year.<sup>5</sup>
- US organizations spend \$15 billion per year manually keying data from forms; for a mid-to-large sized company, this is about \$8,000 per day. In addition, manual entry introduces a 2 to 4% error rate.<sup>6</sup>
- Manual data entry introduces a 0.1 to 2.3% error rate in clinical studies.<sup>7</sup>
- Most companies have data quality problems. An industry survey found only 16% of respondents reported data accuracy greater than 91%.<sup>8</sup>

#### Informed Action Needed

Dr. Lawrence Lapede, research director at the MIT Center for Transportation and Logistics and head of its Supply Chain 2020 project, contends that visibility is not, and never was, the real issue. **What matters is what one does about things—conditions, events, trends—that have become visible.** At the end of the day, informed action trumps information alone.

Source: A. Van Bodegraven and K. Ackerman, DC Velocity, "Whatever Happened to Visibility?" [http://www.dcvelocity.com/viewpoints/?article\\_id=82](http://www.dcvelocity.com/viewpoints/?article_id=82), August 2006.

As we've described, the problem of supply chain visibility is complex; solving it is likely to require several tools. The challenge, however, begins with the ability of the supply chain partners to collect and distribute operational data. EFM technologies can facilitate the execution of this crucial first step by building the collaborative communications infrastructure that these real-time, paperless exchanges require. Although technologies such as Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP) software, email, carrier and 3PL tracking systems etc. exist, in many cases they are expensive or difficult to implement, thus not readily available for everyone who would like to use them. EFM

<sup>3</sup> Capgemini, Georgia Southern University and the University of Tennessee in partnership with Oracle and Intel, 15<sup>th</sup> Annual Report – Year 2006 Report on Trends and Issues in Logistics and Transportation, "The Power of O3: Optimized Strategy Planning and Execution," [http://www.capgemini.com/resources/thought\\_leadership/the\\_power\\_of\\_o3\\_optimized\\_strategy\\_planning\\_and\\_execution/](http://www.capgemini.com/resources/thought_leadership/the_power_of_o3_optimized_strategy_planning_and_execution/), 2006.

<sup>4</sup> Aberdeen, "A View from Above..." 2007.

<sup>5</sup> Data Warehouse Institute, "Data Quality and the Bottom Line: Achieving Business Success through a Commitment to High Quality Data," <http://www.tdwi.org/display.aspx?id=6045>, 2002.

<sup>6</sup> Pacific Crest Securities and Harvey Spencer Associates, 2000. Several papers by Adobe referenced the Harvey Spencer 2000 study but no original source could be found. See [www.adobe.com/products/lifecycle/pdfs/95009142\\_lc\\_barcode\\_sb\\_ue.pdf](http://www.adobe.com/products/lifecycle/pdfs/95009142_lc_barcode_sb_ue.pdf)

<sup>7</sup> "Measuring Outcomes of Clinical Connectivity Trial: Investigating Data Entry Errors in the Electronic Primary Care Research Network." March-April 2007 <http://www.jabfm.org/cgi/reprint/20/2/151>

<sup>8</sup> Aberdeen, "A View from Above..." 2007.

technologies can benefit companies of varying sizes and levels of technical sophistication by providing them the means to track cargo, connect with new and existing shipping partners, and expedite the paperwork process.

The Columbus EFM deployment test featured an independent evaluation that examined quantified and non-quantifiable benefits that would result from implementation of EFM for all shipments in the host supply chain.<sup>9</sup> A CEFM evaluation report documented the results, which are summarized in this report along with benefits found in industry surveys, articles, and reports. Table 1 below is a summary of benefits information contained later in this report.

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<sup>9</sup> SAIC and North River Consulting Group, "CEFM Final Evaluation Report," sponsored by USDOT Research and Innovative Technology Administration, June 2008. [http://www.itsdocs.fhwa.dot.gov/JPODOCS//REPTS\\_TE/14442.htm](http://www.itsdocs.fhwa.dot.gov/JPODOCS//REPTS_TE/14442.htm)



**Table 1. Comparison of CEFM Benefits and Documented Industry Benefits from Visibility Technologies**

EFM Function	Benefits	
	CEFM	Industry
<b>Productivity:</b>		
Booking, Tendering, On-Demand Status Reports (Personnel Productivity)	<ul style="list-style-type: none"> <li>◆ Reduced manufacturer data entry by 75%</li> <li>◆ Reduced forwarder data entry labor by 50-65%</li> <li>◆ Increased # shipments/week processed by Customs broker by 18%</li> </ul>	<ul style="list-style-type: none"> <li>◆ Reduced processing effort by 8-15%</li> <li>◆ Large firms place a high importance on electronic tendering of shipments</li> <li>◆ 78% of companies are able to easily access data needed for decision-making.</li> </ul>
Robust XML messages with automated data for visibility	<ul style="list-style-type: none"> <li>◆ Improved data accuracy at CFS by 25%</li> </ul>	<ul style="list-style-type: none"> <li>◆ 44% of Aberdeen survey respondents do not have online visibility into trade documentation flow and 36% are planning to enhance their current capabilities</li> </ul>
Automated messaging to reduce information exchange effort	<ul style="list-style-type: none"> <li>◆ 10% improvement in data availability on warehouse floor (specifically, ASN); allows better staff planning and forecasting of workload</li> </ul>	
<b>Data quality and availability:</b>		
Frequency of data updates	<ul style="list-style-type: none"> <li>◆ Near real-time data for all partners, eliminating rekeying</li> </ul>	<ul style="list-style-type: none"> <li>◆ 44% of Aberdeen survey respondents do not have online visibility into trade documentation flow</li> </ul>
Data accuracy	<ul style="list-style-type: none"> <li>◆ Improved data accuracy at CFS by 25%</li> </ul>	<ul style="list-style-type: none"> <li>◆ 50% per shipment savings in administrative costs from improved visibility and improved data accuracy from reduced manual data entry</li> </ul>
Data timeliness	<ul style="list-style-type: none"> <li>◆ Data received by supply chain partners 6-72 hours sooner</li> </ul>	<ul style="list-style-type: none"> <li>◆ Increased timeliness of shipping information by 30%</li> </ul>

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## BUSINESS IMPROVEMENT GOALS FOR SUPPLY CHAIN MANAGERS

The potent mixture of globalization, deregulation and advances in information technology has had two large impacts. First, supply chain efficiency and effectiveness improved significantly over two decades, dropping logistics costs from 16 percent of US GDP to as low as 8 percent.<sup>10</sup> Second, supply chain managers and their seniors continue to push for continuous improvements, their appetites whetted by past achievements and multiplied by increasing external pressures such as fuel volatility, security compliance requirements and financial upheaval.

## INDUSTRY APPROACHES TO SUPPLY CHAIN IMPROVEMENT GOALS

Corporate success is measured in financial terms, such as Return on Investment (ROI) and operating margins. Other measures relate to competitive standing (market share) and the loyalty of good customers—the ability to attract and retain the most profitable accounts and relationships. The role of the supply chain and its managers is to support and contribute to those corporate goals.

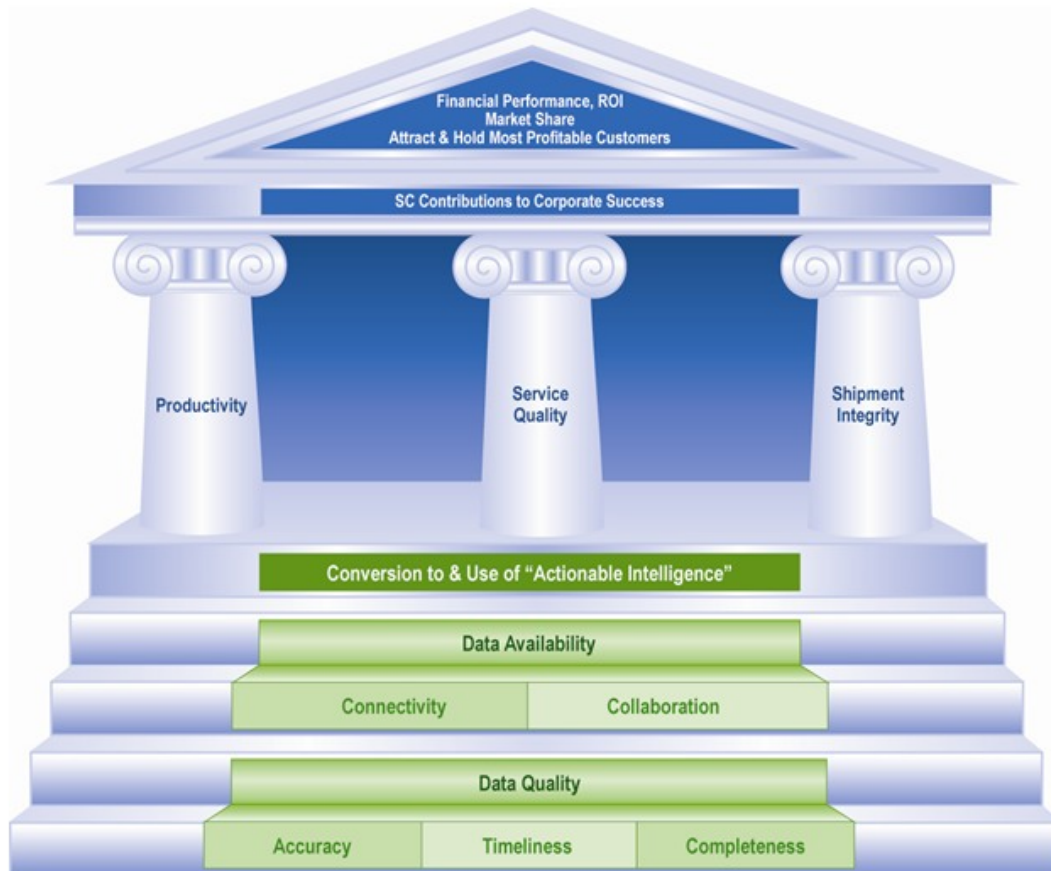


Figure 1. Connections among Corporate Goals, Supply Chain Capabilities and EFM Technologies

<sup>10</sup> Capgemini, Georgia Southern University and the University of Tennessee, The 2007 Supply Chain Playbook – 16<sup>th</sup> Annual Trends and Issues in Logistics and Supply Chain Management, "The Logistics Playbook," 2007.

[http://www.us.capgemini.com/industries/ind\\_tl.asp?IndID=19](http://www.us.capgemini.com/industries/ind_tl.asp?IndID=19)

Supply chain managers support corporate goals in three business domains under their control: Productivity, Service Quality, and Shipment Integrity, which most managers also know to be the major areas to achieve supply chain efficiencies and business benefits. EFM proved that data quality is the foundation for supply chain performance improvements; its components are data accuracy, timeliness, and completeness. Data availability, making quality data accessible to users, begins with connectivity—effective, robust one-to-one, one-to-many and many-to-many connections among supply chain partners, customers and public agencies. Connectivity enables collaboration, which includes process integration across partnerships, such as planning, forecasting and monitoring shipments. The top foundation layer in Figure 1 represents the critical leverage point: the conversion of available data into “actionable intelligence,” information that can be *and is used* to control and improve supply chain operations and results.

All three layers in the foundation are necessary ingredients for producing excellent supply chain business results. Each of the three layers offers opportunities to enhance performance and deliver benefits such as greater productivity and shipment quality. The impacts of the EFM test in Columbus (CEFM) were primarily in the data availability layer of the foundation. EFM and related IT tools focus on data connectivity and collaboration, but they also reach down and up: the core features of EFM help improve data quality, especially in terms of accuracy and timeliness. And looking above, EFM enables supply chain managers to convert data into useful information and then use it to enhance operational performance.

EFM and related technologies are significant contributors to enhanced visibility and that makes visibility an important facet of any story about the business benefits of EFM. There are few public reports or case studies of visibility improvements that describe realized monetized benefits, but there are many confident reports about visibility and data improvement projects that describe non-monetized and qualitative indicators.

When evaluating EFM, we looked particularly for metrics related to or affected by data management and visibility systems. Table 2 shows the primary metrics clusters we gleaned from the literature: two relate to benefit columns in Figure 1 and one relates to the foundation layers of data quality and availability.

**Table 2. Metrics Most Related to Benefits of Data Management and Visibility Systems**

Productivity	Service Quality	Data Quality & Availability:
Transportation costs; transportation efficiency*	On-time delivery*	Frequency of data updates
Personnel productivity*	% of shipments expedited; time to resolve transit problems	Data accuracy
Asset utilization*	Lead time reliability	Data timeliness
Inventory days of supply	Variation in order cycle time*	
End-to-end cycle time*	% of orders shipped on schedule	
Supply chain costs as % of revenue	% of orders not in stock	
(10)		
Administrative costs		

\* High visibility/high data accuracy firms use these metrics much more than low visibility firms.

Simply *using* the six “starred” metrics is an indicator of supply chain sophistication. Capgemini’s latest annual supply chain survey divided respondents into “high visibility” or “low visibility” groups. The high visibility/high data accuracy firms reported much more use of the starred metrics than the low visibility firms.

Data availability metrics offer insights into which firms are technology leaders, followers or laggards, and which firms have the greatest potential benefits to achieve from successful technology innovation. Other indicators of leading, lagging and benefit potential are methods of data exchange (such as web services, EDI, fax or voice) and sophistication of support tools (such as optimization models or spreadsheets).

## GOALS OF THE EFM PROGRAM

The core features of EFM provide a platform to exchange information among trading partners on a many-to-many basis over the web. The main goal of the USDOT EFM program is to enable greater supply chain productivity and service quality by improving the quality and availability of supply chain information without the deployment of private, proprietary services. The first step in assessing the achievement of this goal was the execution of the six-month CEFM deployment test.

Specific goals of the CEFM test included:

- Automate business interactions among multiple partners along a single international supply chain.
- Provide shipment status and documentation in near real-time.
- Improve data accuracy of information associated with freight management.
- Utilize standardized electronic data definitions and formats, especially those which businesses already have in place.
- Maintain confidentiality of partner data while allowing authorized partners to have access to sensitive business data.
- Demonstrate the ability to support small, medium and large businesses with non-proprietary tools using the Internet and standardized electronic information.

Following the completion of the CEFM test, the next step in the EFM program is the execution of the first EFM case study, which is taking place with a small supply chain based in Kansas City, MO. This case study involves a small-scale deployment and short-term use of the EFM core features. The case study went live on February 27, 2009.

In this test, the case study participants and deployment team will conduct a self-evaluation; the case study’s supply chain owner has specific productivity and service quality goals to achieve through their use of EFM. The case study will look closely at the impact of improved data availability on some of the productivity and service quality metrics that they already collect, so there will be good “before” baseline data. The concept with the EFM case study in Kansas City is to focus on a small but

effective number of metrics, particularly productivity measures in the warehouse. Industry partners, developers and case study sponsors have vetted these metrics.<sup>11</sup>

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<sup>11</sup> Battelle (D. Williams) and EDS – an HP company (Matt Gatewood), email to Diane Newton re: Kansas City Performance Metrics, October 2008.

## ELECTRONIC FREIGHT MANAGEMENT TECHNOLOGIES

EFM and other visibility technologies include three functional capabilities:

- Connectivity with supply chain partners to obtain needed data
- Collaboration of business processes with partners
- Creation and use of actionable intelligence to improve the supply chain

EFM technologies move connectivity beyond phone calls, faxes and even EDI toward automated computer-to-computer information exchange. Technologies transform collaboration from the simple linkage of systems toward integrated business processes. Technologies that create actionable intelligence go beyond the creation of pretty charts and screen layouts and towards accessible tools that transform data into decision support information for both normal operations and unplanned disruptions, large and small.

EFM and visibility technologies provide the data and analysis capabilities for supply chain visibility, productivity and effectiveness. We created the table at the right from Capgemini's 15th and 16th Annual Reports on Trends and Issues in Logistics and Supply Chain Management, each of which drew on more than 1100 respondents.<sup>(12, 13)</sup> While the table shows a sharp year-on-year decline, in 2007 more than 15% of respondents still managed their supply chains with manual processes including spreadsheets. The table also shows the penetration of some automated supply chain tools.

Primary Tools in Domestic Logistics		
	2006	2007
Manual/spreadsheets	25.0%	15.2%
Third party providers	23.3%	5.8%
In-house developed software	18.2%	27.5%
Best of breed commercial software	14.8%	20.6%
Commercial software in ERP	14.2%	29.1%

*Note: These were the primary responses and do not add up to 100%. Respondents may or may not have been using the same definitions in their answers in each year.*

In its June 2005 survey of 200 logistics personnel in Fortune 500 companies, eyefortransport reported that almost all respondents identified better technologies as the principal way to overcome major supply chain issues.<sup>14</sup> The top three issues, each with more than 70% support, were data integration, lack of visibility, and lack of collaboration with partners.

## VISIBILITY TECHNOLOGIES IN INDUSTRY

Increasingly complex global supply chains have about 60 data sources within and especially outside the company.<sup>15</sup> The objective, of course, is to have near-real-time information from each source entered once and in a timely manner so that all concerned parties can maintain accurate visibility, whether end-to-end or just those segments of particular interest. Integrating all of the information

<sup>12</sup> Capgemini, Georgia Southern University and the University of Tennessee in partnership with Oracle and Intel, 15<sup>th</sup> Annual Report (2006) "The Power of O3: Optimized Strategy Planning and Execution," [http://www.capgemini.com/resources/thought\\_leadership/the\\_power\\_of\\_o3\\_optimized\\_strategy\\_planning\\_and\\_execution/](http://www.capgemini.com/resources/thought_leadership/the_power_of_o3_optimized_strategy_planning_and_execution/), 2006.

<sup>13</sup> Capgemini, et. al, "The Logistics Playbook," 2007.

<sup>14</sup> eyefortransport, "Fortune 500 Companies Views on the Supply Chain Landscape," <http://events.eyefortransport.com/reportstore.shtml>, July 2005.

<sup>15</sup> Capgemini, et. Al, "The Power of O3," 2006.

at the right time is not easy. An adaptive global supply chain is impossible without the access to accurate, timely and complete supply chain data. This requires electronic connectivity among supply chain partners and an ability to pull together and translate all of the data into usable information.

Connectivity in a supply chain may involve one-to-one communications between partners, say a shipper and its freight forwarder. Given multiple suppliers, service providers, and even customers, many-to-many communications is even more important and more difficult. Most companies, particularly large established shippers and most transportation carriers use EDI to exchange data. EDI is typically a batch process between two partners in an industry-accepted standard format. There are also many value added networks (VAN) that act as gateways. The advantage is that a partner need only communicate with the VAN which then sends the transaction on to its intended recipient(s). A disadvantage of the VAN is the transaction fee. VAN service is certainly cheaper than establishing individual one-to-one EDI interfaces, but can still represent a meaningful operating cost to a user. One of the words we often saw associated with EDI in industry literature was “expensive.” Large companies may send EDI every hour or two and would usually batch together multiple EDI transactions, but this frequency may not be sufficient for rapid decision-making across a global supply chain.

### ***Connectivity and Collaboration Networks***

Enter the web or the Internet: connectivity and collaboration became easier and less expensive for companies. The Internet revolutionized electronic communications and made it much easier for relatively unsophisticated parties to communicate. Although email is part of the “manual/spreadsheet” category in the Capgemini table above, almost all companies use it to transfer virtually for free documents they used to send by regular mail or courier. In addition, a company wanting to receive supply chain data can provide a web portal that allows partners to input or view data with nothing more than an Internet browser.

Most companies lack the size or ability to create their own collaboration network, but there are a growing number of companies that provide web-based supply chain connectivity and collaboration tools. Often these third parties have networks to interconnect many shippers and other partners. An advantage of a network is the ability to add new partners quickly and easily, offering immediate connection with multiple partners to new users.

There are other examples of partner collaboration networks. Some, including GT Nexus, ClearTrack, GXS, and Descartes, are software and supply chain service providers that claim thousands of customers which are potential supply chain partners. Electrolux is an example of a shipper that established its own network to tie in its supply chain partners. Electrolux has a supply chain collaboration network that uses commercial software from Axway. Recently, Electrolux acknowledged that collaboration for improving processes is hard.<sup>16</sup> Their network ties its partners together by supporting multiple standards and communications protocols, rather than forcing partners to adapt to a single standard

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<sup>16</sup> Electrolux, Supply Chain Television Channel webinar on supply chain collaboration, September 25, 2008.

or protocol. The Electrolux network functions as a translator or gateway. They also offer WebEDI for partners that don't have traditional EDI.

GT Nexus' underlying network infrastructure communicates over the web, connecting partners with each other and with GT Nexus, using on-demand supply chain software. GT Nexus reports about 15,000 companies on its network and supports many different formats to

facilitate data communications among the customers. The network involves minimal set-up costs and maximum flexibility which helps new customers to start quickly and cost effectively.

#### Six Examples of Supply Chain Communications Networks

- **GT Nexus**, formed by the ocean carrier industry, maintains a communications network that connects 15,000 potential trading partners.
- **Descartes** Global Logistics Network is a multi-modal network of transportation providers and their customers to facilitate information exchange.
- **Elemica**, formed by a group of chemical industry companies, operates a global network & exchange for industry best practices. Connected solution with 1800 partners.
- **ClearTrack** Information Network operates a Global Network for consumer retailers and connects more than 1000 manufacturers, transportation carriers, forwarders, and 3PLs
- **Electrolux** operates a collaboration network that allows all of its trading partners to communicate with Electrolux either via EDI or WebEDI. Axway provided the software solutions.
- **GXS** Trading Grid supports all EDI and XML standards worldwide and provides B2B e-commerce globally for the consumer and retail goods industry. The Trading Grid also includes a web portal on line version that provides transaction visibility.

#### *Service Oriented Architecture (SOA) and Web Services*

EFM and some other logistics applications use both Web Services and SOA to take advantage of the power of the Internet and XML for data exchange:

A Web Service is a reusable computer application (like a subroutine) that transfers data via standard data and communications formats over the Internet. Web Services are self-describing components that client applications can recognize by look-up in a registry.

Service Oriented Architecture (SOA) is a software architecture approach where the basic elements of design and development are applications that communicate with each other through Web Services. The ultimate goal of the SOA is to facilitate information exchange.

Open architecture and Web Services allow supply chain partners to automate daily business interactions and streamline business processes by facilitating cross-agency messaging and by containing a Yellow Pages-like function that standardizes the directories of information on Web Services (listing their capabilities, location, input requirements, and expected output or service performed). Because direct partner connections via Web Services use the Internet, there is no transaction or network fee as there is when EDI is provided through a VAN. Collaboration networks described above charge a subscription fee or a lower per unit communications cost than VANs.

Many transportation companies now offer Web Services connectivity to their customers. Examples include Yellow Freight, UPS, and FedEx. The Web Services make it easier to get connected, which produces labor savings.



SOA architecture enables the integration of best practice processes within a supply chain. Standards-based SOA allows easier expansion of process and data integration throughout the supply chain.

Using SOA, staff within a company can view multiple databases simultaneously. SOA holds the pieces together and delivers a consolidated view of the supply chain. It enables a total view of the supply

#### Future of SOA

Going forward, SOA will be the prime enabler for supply chain leaders to achieve their sought-after competitive advantages.

Capgemini, 2006

chain by making it easier for partners to provide data and then making that data more accessible to the user.

SOA-enabled systems allow end users to pick the parts—or services—they need from among all installed systems and to assemble them into a business process that meets specific requirements. It enables it without major integration efforts and the time and cost they entail.

Dow Chemical uses SOA and a Web Services-based portal to pull together and distribute their visibility information. A third party, Savi Technology, hosts the portal for them. The system does automated filtering and allows management by exception.

## CEFM DEPLOYMENT TEST TECHNOLOGY

As noted earlier, one of the goals of the USDOT EFM program is to accelerate the deployment and use of high payoff electronic technologies to improve freight efficiency. The core architecture in EFM includes SOA and Web Services. The CEFM deployment test integrated multiple partners and networks using SOA and Web Services while exchanging and sharing data, maintaining security of the information exchanges, and protecting the integrity of individual partner systems. The tested supply chain included trading relationships among thirteen partners including four manufacturers and two freight forwarders; transport was primarily by air from China to Columbus, Ohio. The key aspects of the CEFM test were:

- Data was entered once and used many times.
- Information sharing was in near real-time, based on when data entered partners' back-office systems.
- Implementation of data standards – secure exchanges over an open architecture using XML messages written per Universal Business Language (UBL) schemas.
- Trading partner access to status reports via the Web – one partner integrated CEFM data into its back office system.

#### CEFM Vital Stats

- 6 month deployment test
- LB air cargo supply chain with 13 partners
- 871 completed consignments (10% of total volume on this route)
- 21 pieces of shipment information provided via:
  - 2 points of manual entry (PO booking and tendering)
  - 18 automated status messages
  - 3 on-demand reports

CEFM used 21 Web Services to obtain, store, and automatically send and receive shipment status information among supply chain partners; stored the data separately; and then exchanged the data with other trading partners. These Web Services provided a simplified means of communicating and sharing shipment information.

Building upon the success of the CEFM deployment test, DOT and the EFM integration contractors began working with Demdaco on the first EFM case study in Kansas City; a small importer and warehouse operator, Demdaco's business goal in applying EFM to their operation is to improve visibility of inbound ocean container shipments. The objective is to have complete status information in one place and to display most of the data on a web portal so that small and medium size partners will need little technology to participate. The several-month deployment will be bolstered by coordination with several other improvement initiatives in Kansas City.

## CREATING AND USING ACTIONABLE SUPPLY CHAIN INTELLIGENCE

Even accurate real-time information is of limited value to a supply chain user until that information is applied to manage the supply chain. In order to apply the information, it is as important to integrate supply chain information with back office systems as it is to automate input from external partners. This begins to create actionable intelligence – and it reduces data errors associated with re-keying.

Here are some examples of the use of actionable supply chain intelligence:

- View shipments by exception and provide alerts for action
- Track shipments and provide tracking data to customers
- Divert in-transit shipments to higher priority destinations
- Provide advanced customs clearance (import and export) data
- Provide alerts about data quality problems and notify users to investigate
- Provide dashboards of status information and operating statistics based on company-defined performance measurement

Visibility software pulls together information from all supply chain partners into one place and provides a mechanism to share information. This enables parties to a shipment to see “all the spokes in the wheel.” Some software products have capabilities that provide the ability to look up multiple pickups and drops, and examine and develop distribution strategies. Software vendors provide tools for analyzing the data, generating reports, and highlighting exception information.

The types of software that can create and use actionable intelligence from visibility data include Transportation Management (TMS) and Global Trade Management (GTM) systems. As shown earlier, over a quarter of surveyed companies, particularly the larger shippers, develop their own transportation management software. Increasingly, companies are using on-demand software over the web or SaaS (software as a service). In fact, many TMS providers are transitioning to SaaS. SaaS suppliers tend to have the kind of SOA and Web Services-oriented networks and infrastructure which make for easier data exchanges. SaaS could be particularly useful to small and mid-sized companies because it requires only an Internet browser. In conversations with the authors, Aberdeen indicated that only a small percentage of small and mid-sized companies use visibility software. This may reflect a potential market for on-demand services. However, the point here is not the superiority of a particular software business model; the point is that actionable intelligence requires integrated logistics software.

The 2008 *Logistics Management* Survey of 422 respondents found that one-third of respondents (or 141 respondents) are planning to add an on-demand application in the coming year.<sup>17</sup> A contributor to the analysis of the survey results estimated that one third of the TMS market is for on-demand. One software supplier wrote recently that on-demand projects were the fastest growing segment of its business for large and mid-sized shippers as well as 3PLs.<sup>18</sup>

As a specific industry example of actionable intelligence, Dow Chemical is integrating its visibility capability with its back office systems. Dow's system picks out problems related to high hazard shipments and links directly to the chemical industry's reporting system, CHEMTREC. In addition, Dow expects to allow their customers to tap their system and track the location and status of shipments. Also, Sterling Commerce reported on an August 2008 survey of over 400 logistics professionals that slightly more than half automatically check quantities and dates of advance shipments and commitments against purchase orders.<sup>19</sup> They also wrote that a majority of shippers currently track shipments through carriers' websites. Respondents identified *ad hoc* reporting as an important feature of software. Interestingly however, only one-third of respondents said their supply chain solution was "top notch" and one-fourth said their reporting capabilities were inadequate.

By design, CEFM was primarily a data exchange system and not a TMS. CEFM was not intended to provide more sophisticated TMS functionality aside from a supply chain events report about each shipment. However, users in the CEFM Deployment Test reported substantial opportunities for taking action based on CEFM data even as they acknowledged that the test only dealt with about 10% of shipments in a parallel testing environment that kept data on remaining shipments separate in existing systems and processes. CEFM used Web Services to exchange status information among partners and extracted information from partners' in-house developed software or visibility systems. One CEFM partner integrated CEFM data directly into their back office systems. That partner found numerous uses for acting on CEFM data. Even though other partners did not integrate, CEFM users identified opportunities including use of advanced information to plan and forecast arrival of shipments at downstream locations. The test evaluators found integration is crucial in order to achieve the full benefits of reduced data entry and increased data quality. Capgemini's 2008 survey (17<sup>th</sup> Annual) reinforced that finding when, for the first time, it highlighted the wide use of legacy software that is integrated through an automated process as a transportation tool.<sup>20</sup> It is this integration that yields actionable intelligence.

### Legacy System Integration

Some companies are also examining the use of legacy software what has been integrated through an automation process that does not require writing code or changes to existing systems...This [solution] provides a seamless flow of information by connecting the data and information from all the key supply chain elements.

14.3% of domestic and 18.8% of international respondents use this solution (1069 total respondents)

Capgemini, 2008

<sup>17</sup> *Logistics Management*, 6<sup>th</sup> Annual Supply Chain Software Survey, <http://www.logisticsmgmt.com/article/CA6549320.html>, April 2008.

<sup>18</sup> Harrington, Lisa, Inbound Logistics, "Ground Tactics: Optimizing Transportation Networks," [http://www.inboundlogistics.com/articles/features/0908\\_feature01.shtml](http://www.inboundlogistics.com/articles/features/0908_feature01.shtml), September 2008.

<sup>19</sup> "A Study on Inventory Visibility Among Logistics Professionals," conducted by Reed Business Information on behalf of Logistics Management, sponsored by Sterling Commerce available at: <http://www.scmr.com/contents/pdf/SterlingCommerce.pdf>, August 2008.

<sup>20</sup> Ibid.

In the EFM case study in Kansas City, Demdaco will conduct back office integration of the supply chain data into its system and will use EFM for managing all of its shipments; reports will be available through the EFM user interface to aid all of the partners in taking actions.

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## BENEFITS REALIZED BY DEPLOYING EFM TECHNOLOGY IMPROVEMENTS

### BROAD INDUSTRY BENEFITS

Industry literature reviews and evaluator experience in successful electronic freight management technology implementations show that quantifying visibility improvement is difficult but important. Quantification is a key factor in many companies' decision to adopt new supply chain technology.

In its September 2007 Aberdeen report *A View from Above: Global Supply Chain Visibility in a World Gone Flat*, Aberdeen Group included a chart on some 38 companies that responded to the survey with dollar benefits gained through the use of supply chain visibility software.<sup>21</sup> The September 2008 Aberdeen report *Beyond Visibility: Driving Supply Chain Responsiveness*<sup>22</sup> included an expanded survey response from a total of 349 companies. Of these, 101 companies partially or fully estimated the economic impact of supply chain visibility technology. Aberdeen also dug deeper into their expanded survey, looking for additional benefits information. Responding to SAIC and North River requests, Aberdeen completed a second September 2008 report, *Supply Chain Visibility Software Benefits*.<sup>23</sup>

The box at the right highlights an important finding: the benefits of visibility software grow and become more apparent as users' gain familiarity and experience with their system.

Companies that have been using a supply chain visibility improvement initiative for more than two years are more likely to achieve the large quantity benefits than all other companies.

Aberdeen Group, September 2008

We adapted some of the Aberdeen data, collapsing categories to produce Table 3, which shows the relationship between reported benefits and company size, expressed in revenue. In analyzing the Aberdeen data, we drew several points about the relationships among size of firm and achievement of benefits:

- 46% of smaller firms report benefits of greater than \$100,000.
- More than twice as many smaller firms report meaningful benefits (>\$100,000) than report no payoff or loss.
- Almost as many smaller firms report significant benefits (>\$500,000) as report no payoff or a loss.
- Twice as many large firms report significant benefits (>\$500,000) as report no payoff or a loss from a visibility software project.
- Half of the firms that reported measuring benefits were large firms with revenues greater than \$2.5 Billion, although only 42% of the 349 companies in the overall survey were large firms.

<sup>21</sup> Aberdeen, "A View from Above..."2007

<sup>22</sup> Aberdeen Research Group, "Beyond Visibility: Driving Supply Chain Responsiveness," <http://www.aberdeen.com/summary/report/benchmark/5300-RA-supply-chain-responsiveness.asp>, September 2008. The survey used in this report was the basis for the analysis for SAIC and North River noted in #24.

<sup>23</sup> Aberdeen Research Group, Analysis for SAIC and North River Consulting Group, "Supply Chain Visibility Software Benefits," based on Aberdeen's August-September 2008 survey.

- For the 23% with more than \$3 million in benefits (23 companies), 56% (13 companies) are large companies with revenues greater than \$5 billion.

Aberdeen analyzed the difference between domestic and global supply chains. Not surprisingly, most firms reporting benefits greater than \$3 million had global supply chains; and most firms reporting less than \$250,000 had domestic supply chains. This survey response of 101 companies is the largest reporting of quantified benefits that we found in our research and shows that companies do benefit from implementation and use of visibility technologies.

**Table 3. Visibility Benefits by Size of Company**

Annual Revenue Benefits/Costs Reported	<\$50-\$250 million	\$250 - \$2,500 million	\$2.5 - >\$5 billion
Breakeven or Negative Results	5%	5%	14%
Less than USD \$100,000	9%	2%	0%
USD \$100,001-\$500,000	8%	4%	6%
USD \$500,001-\$3 million	3%	8%	10%
More than USD \$3 million	1%	4%	19%

Source: Adapted from Aberdeen Group, September 2008

The box at the right provides several examples of how respondents achieved benefits from the technologies.

Next we look beyond the Aberdeen surveys for specific examples of benefits at individual companies, then shift to the benefits documented in the EFM program. Taken together we believe these industry and EFM benefits show the efficacy of well-implemented visibility software.

### **Productivity Improvement**

A key to improving productivity is having up-to-date information about orders and status at each step in the supply chain. Visibility technologies help provide that information and reduce costs. Enhanced information can be used in arranging the transportation with carriers and in managing the shipment as it moves from origin to destination. Efficiency savings to firms that use visibility technologies derive from the use of actionable intelligence provided by or developed from improved data quality and availability. EFM and visibility technologies facilitate the knowledge of what is coming and when it will arrive. Minor adjustments in an individual shipment unit's schedule can save the firm money. When the supply chain is reliable and there is accurate information about

### **How Benefits Were Quantified**

- Cycle time improvements and quality exception reporting (small metals manufacturer, benefits not disclosed)
- Cost savings and service improvements (mid-market North American food & beverage company, \$500K-\$1 M)
- Reduction in inventory, obsolescence and better manufacturing asset utilization (large North American pharmaceutical manufacturer, > \$3M)
- Improved in stock, reduced costs, reduced transportation costs (large North American retailer, > \$3M)

Aberdeen Group, September 2008

anticipated arrival, firms can reduce safety stocks and inventories. Near real-time information improves the synchronization of the supply chain.<sup>24</sup>

There are important savings in the administrative costs of supply chain partners throughout the chain. Clearly, activities and processes with manual data preparation and analysis take longer and are likely to have more errors than processes using automated data. Visibility technologies create value as they automate the creation and transfer of data along the supply chain from one partner to another.

### *Improved Service Quality*

While more speed might be most important in some cases, greater delivery time reliability is usually at the core of improved service quality- delivering the product when the customer needs it and when it has been promised. Unpredictably late shipments can cause downstream problems such as lost sales and unhappy customers. One measure in this area is the extent of expedited shipping, which is a supplier's response to unreliable or late shipments. Expedited shipping may achieve the delivery schedule, but at increased cost. Some Capgemini and Aberdeen surveys differentiate between on-time performance by top performing firms and average firms, and the top firms have percentages comparable to those in the table. Variability is also an important aspect of cycle time and Chemlogix found reductions, although it did not report a percentage improvement.

Table 4 shows examples of quantified benefits found in the literature.

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<sup>24</sup> Capgemini, "The Logistics Playbook," 2007.

**Table 4. Quantified Benefits in Industry from Visibility Technologies**

Productivity	
Reduced Transportation Costs	<ul style="list-style-type: none"> <li>◆ 20-30% improvement (Viking Logistics)<sup>1</sup></li> <li>◆ 30% reduction (Infor)<sup>2</sup></li> <li>◆ Reduced expediting of shipments 75% (Distribution Group)<sup>3</sup></li> <li>◆ Reduced cost/parcel by 14% (Lifeway)<sup>4</sup></li> </ul>
Reduced Administrative Costs	<ul style="list-style-type: none"> <li>◆ Reduced processing effort by 8-15% (Accenture)<sup>5</sup></li> <li>◆ Reduced transportation overhead 10-30% (SCD)<sup>6</sup></li> <li>◆ Reduced costs of manual data capture and entry 10-15% (Dow)<sup>7</sup></li> <li>◆ 20% faster response to rate evaluations (Globalink)<sup>8</sup></li> <li>◆ Reduced administrative costs by 50% (Sunoco)<sup>9</sup></li> </ul>
Improvements in Inventory and Shipping	<ul style="list-style-type: none"> <li>◆ Increased shipment consolidation by 5-25% (SCD and Chemlogix)<sup>10</sup></li> <li>◆ Reduced safety stock inventory by 20% (Dow)</li> <li>◆ Reduced inventory levels 25-60% (Viking Logistics)</li> <li>◆ Improved transportation controls and reporting by 2-5% (Chemlogix)</li> </ul>
Service Quality	
	<ul style="list-style-type: none"> <li>◆ Reduction in time to resolve in transit problems by 50% (Dow)</li> <li>◆ Improvements in delivery performance by 16-18% (Viking Logistics)</li> <li>◆ Improved reliability of delivery time to 90% (Dow)</li> <li>◆ Improved on time delivery performance from 94% to 97% (P&amp;G)</li> <li>◆ Improved cycle time by 10-50% (Distribution Group)</li> </ul>
Shipment Integrity <sup>11</sup>	
	<ul style="list-style-type: none"> <li>◆ Visibility cost savings (7%)</li> <li>◆ Increase in on-time deliveries (12%)</li> <li>◆ Increase in access to supply chain data (50%)</li> <li>◆ Increased timeliness of shipping information (30%).</li> </ul>

<sup>1</sup> Viking Logistics, "Principles of Supply Chain Management," undated white paper available at Logistics HQ page on Viking website.

<http://www.viking-logistics.com/uploads/Principles%20of%20Supply%20Chain%20Management.doc>

<sup>2</sup> Infor Solutions Webinar October 22, 2008 Infor reported 30% reduction in transportation costs through use of transportation planning software product.

<sup>3</sup> Distribution Group, "Developing an Effective Business Case for a WMS,"

<http://viewer.bitpipe.com/viewer/viewDocument.do?accessId=8518384> 2005.

<sup>4</sup> "Transportation Management Systems Give Shippers Power to Make Smarter Trucking Choices" by Amy Zuckerman, January 3, 2008, World Trade Magazine. The article described the use of transportation management system by LifeWay, a Nashville TN publisher that reduced cost per parcel by 14%. <http://www.worldtrademag-digital.com/worldtrademag/200801/?pg=34>

<sup>5</sup> Accenture, with Rolls Royce, Diageo, Ernst and Young, Capgemini, Shell and AT&T, "Building the Business Case for e-Procurement and ROI" available at: [http://www.buyitnet.org/Best\\_Practice\\_Guidelines/e-Procurement/docs/building%20the%20business%20case%20-%20ROI.pdf](http://www.buyitnet.org/Best_Practice_Guidelines/e-Procurement/docs/building%20the%20business%20case%20-%20ROI.pdf), 2002.

<sup>6</sup> "Where is the ROI in Transportation Management Systems?" Supply Chain Digest June 15, 2008. Article by the editorial staff notes that users have found transportation overhead reductions of 10 to 30%.

<sup>7</sup> Goodman, Russell, "Dow's Innovative Ways to Cut Shipments of Dangerous Goods," Global Logistics and Supply Chain Strategies, <http://www.supplychainbrain.com/content/industry-verticals/chemicals-energy/single-article-page/article/dows-innovative-ways-to-cut-shipments-of-dangerous-goods/>, December 2006.

<sup>8</sup> Manufacturing and Logistics IT Magazine, "Global Link Logistics Boosts Productivity by 50% with Management Dynamics Solution,"

<http://www.logisticsit.com/absolutem/templates/article-supplychain.aspx?articleid=3824&zoneid=5>, May 8, 2008.

<sup>9</sup> Murphy, Jean C., "Sunoco's Shipping Process Inside its Plant Goes from Manual to Highly Optimized," Global Logistics and Supply Chain Strategies, <http://www.supplychainbrain.com/content/industry-verticals/chemicals-energy/single-article-page/article/sunocos-shipping-process-inside-its-plants-goes-from-manual-to-highly-optimized/>, September 2004.

<sup>10</sup> Skinner, Michael, Chemlogix White Paper "The Time has Come: Visibility into the Transportation Process is now affordable and soon to be expected." 2007 <http://www.chemlogix.com/>. Benefits and improvements included inventory and shipping costs, improved shipment consolidation by 5-25% and improved transportation controls by 2-5%.

<sup>11</sup> Peleg-Gillai, Barchi, Bhat, Gauri, and Sept, Leslie, Stanford University, "Innovators in Supply Chain Security: Better Security Drives Business Value," published by the Manufacturing Institute, [http://www-](http://www-03.ibm.com/procurement/proweb.nsf/objectdocswebview/fileinnovation+in+supply+chain+security+-+better+security+drives+business+value+july+2006/$file/innovators+in+supply+chain+security+-+better+security+drives+business+value+july+2006.pdf)

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## QUALITATIVE BENEFITS IN INDUSTRY

In computing a project's ROI, the consulting firm Business Objects looks beyond comparing quantified direct and indirect benefits to total cost of ownership. Especially when costs exceed quantified benefits, Business Objects recommends consideration of intangible or qualitative benefits before deciding against a project.<sup>25</sup> Higher customer satisfaction and loyalty are among the most important qualitative benefits. Other examples are improved operational flexibility to implement postponement strategies and improved back office flexibility to respond to new regulatory requirements, such as Customs' mandate for more detailed shipment information prior to container loading. We examine qualitative benefits with the same categories of benefits used earlier for quantitative benefits.

### Real-time data => Better Management

Rising transportation costs can be stemmed by leveraging information. Real-time data can enable better management decisions as conditions change. Real-time information, visible across the supply chain, synchronizes and coordinates critical supply chain activities.

Capgemini, 2007

### Productivity Improvement

We found interesting industry discussions of unanticipated or unpredictable performance benefits from visibility and other data improvements. Software and network provider GT Nexus and consultant Business Objects both noted dynamic allocation of inbound inventory and better warehouse capacity planning as useful qualitative benefits.<sup>(26, 27)</sup> They also identified an unanticipated productivity improvement from visibility technologies: cross docking increased when distribution centers had and used more precise and up-to-date knowledge of when shipments will arrive and when they need to be shipped out to customers. Increased cross docking reduced temporary shipment storage and re-handling.

Dow Chemical reported that a qualitative benefit of visibility software is better management of inventories and production. Stanford noted that the right tools "tremendously improve visibility and timeliness of information" to detect data inaccuracies earlier. Stanford also noted that automation can eliminate process steps, reduce the time it takes to perform remaining tasks and make it possible for lower-skilled workers to perform higher-level tasks. GT Nexus explained that visibility technologies can provide a better understanding of total landed costs.

### Improved Service Quality

High quality customer service supports customer retention and growth. GT Nexus and Business Objects identified two qualitative and unanticipated service improvements from visibility technologies:

<sup>25</sup> Mark Ritacco and Astrid Carver, Business Objects. "The Business Value of Business Intelligence: A Framework for Measuring the Benefits of Business Intelligence" <http://businessobjects.com/> 2007.

<sup>26</sup> GT Nexus (benefits: increased cross-docking, dynamic allocation of inbound inventory, better warehouse capacity planning, and more effective back order prioritization. GT Nexus White Paper: GT Nexus White Paper, "Global Sourcing: Elusive Profits, Expensive Mistakes," register online to receive a pdf copy at: [http://www.gtnexus.com/press\\_room/resource\\_library\\_form.php?doc=white\\_papers/global\\_sourcing\\_landed\\_costs\\_wp.pdf](http://www.gtnexus.com/press_room/resource_library_form.php?doc=white_papers/global_sourcing_landed_costs_wp.pdf), 2007.

<sup>27</sup> Mark Ritacco and Astrid Carver, Business Objects. "The Business Value of Business Intelligence: A Framework for Measuring the Benefits of Business Intelligence" <http://businessobjects.com/> 2007.

- More effective back order prioritization. Knowing what shipments will arrive when allows better planning of deliveries to customers.
- Better responses to new customs/trade requirements such as the so-called 10+2 information that will be required by Customs and Border Protection (CBP) for import shipments starting in 2009 (identification of the overseas origin, U.S. destination, and contents of a shipment). Automatically available end-to-end supply chain data can help satisfy enhanced customs requirements. Many commercial visibility software packages include such compliance support capabilities and the vendors provide updates as requirements change.

Other documented service improvements include:

- Higher customer confidence (Dow Chemical).
- Greater flexibility, allowing implementation of postponement strategies (consultant Boston Logistics).<sup>28</sup>
- Reduction in out-of-stock conditions (Proctor and Gamble)
- Eliminated manual track and trace of orders, reducing costs and the opportunity for errors while helping increase delivery reliability and customer satisfaction (Proctor and Gamble).
- Reduction in alerts for late pick ups or deliveries (Chemlogix).

These qualitative service improvements reflect agile supply chains that adapt quickly and easily to customer needs and supply chain disruptions. Appropriate technologies, such as Web Services and SOA, speed the reconfiguration of applications and processes when changes occur. Agile supply chains also provide timely exception reports and facilitate corrective actions.

### ***Improved Shipment Integrity***

Shipment integrity includes loss and damage, theft, and cargo security. While not the subject of most industry research or the CEFM deployment test, visibility software can improve shipment integrity. If you improve end-to-end shipment visibility, then there is less opportunity for shipments to be delayed en route with greater exposure to theft and other security threats. And if something goes wrong, improved visibility may enable a supply chain manager to learn about the problem and take corrective action sooner. Some visibility software solutions include exception alerts to warn of late shipments and other problems. In a recent conference presentation, Dow described elimination or early detection of product theft by using supply chain visibility technologies.

In a June 2008 report, Gartner said that some software vendors were enhancing their products to support the 10+2 information requirement for 2009. Visibility software and enhanced supply chain data cannot guarantee compliance with 10+2, but automated data makes it more likely and easier to accomplish. Gartner noted that without software with 10+2 capability, most shippers won't have

<sup>28</sup> Boston Logistics, Economic Development Research Group, and Cambridge Systematics "Guide to Quantifying Economic Impacts of Federal Investments in Large-scale Freight Transportation Projects." August 2006. Appendix A, "Integrating Supply Chain Benefits into Economic Analysis" contains detailed information on transportation cost and inventory reductions.  
<http://www.dot.gov/freight/guide061018/>.

mechanisms in place to capture the data, organize it, and provide it to CBP in the required time frame.<sup>29</sup> Maintaining the shipment integrity helps assure high quality customer service and saves money through better management of the supply chain.

## **BENEFITS DELIVERED BY THE EFM PROGRAM**

The Columbus EFM deployment test featured an independent evaluation that examined quantified and non-quantifiable benefits that would result from implementation of EFM for all shipments in the host supply chain.<sup>30</sup> A CEFM evaluation report documented the results, which are summarized in this section. The final pages of this section compare the broad industry and CEFM findings and then describe benefits anticipated in the Kansas City EFM case study.

Based on test data and Chinese, Hong Kong, and U.S. labor rates and discussions with the Columbus partners, we quantified the labor savings that could accrue to each partner as a result of improved information from EFM. We computed daily savings for CEFM identified for the particular partners.

While the quantified savings accrued primarily to the individual supply chain partners, we made a key assumption that a derivative benefit could accrue to the shipper or supply chain owner through the long-term use of EFM technologies: it is in the supply chain owner's interest for its partners to become more efficient. For example, more efficient manufacturers and freight forwarders may be able to reduce their rates to the shipper.

We interviewed each supply chain partner to gauge CEFM user reactions and their insights about the impact of CEFM if it were fully implemented and integrated with existing operating management systems. Most of the conversations centered on higher-level supply chain productivity categories such as cycle time, transit time, and schedule adherence. Users seemed confident that CEFM data, if integrated with transportation management capabilities, would improve the higher-level business metrics.

Table 5 summarizes the benefit findings of the CEFM deployment test and validates them with information from the industry studies of EFM-type of solutions. We believe the table shows how CEFM filled current information and visibility gaps that have been identified by other studies and surveys. This table helps to interpret the level of benefits that can be achieved by different types of partners along different supply chains – like smaller, less automated partners, or partners without visibility over other supply chain members.

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<sup>29</sup> Klappich, Dwight, "US Customs 10+2 Legislation Will Drive Further IT Spending for Importers" Gartner, Inc. <http://mediaproducts.gartner.com:80/reprints/log-net/156651.html> June 5, 2008

<sup>30</sup> CEFM Final Evaluation Report, June 2008.

**Table 5. CEFM Benefits**

EFM Function	Category	CEFM Benefit	Industry
PO Booking and Tendering	Productivity	<b>\$27/day</b> (Chinese manufacturer labor); <i>5 minute per PO savings, a 75% reduction. 2 data elements vs. 8 data elements</i>	Large firms place a high importance on electronic tendering of shipments. <sup>i</sup>
On-demand status reports	Productivity	<b>\$25/day</b> (overseas forwarder labor); <i>Reduced labor on pre-alert by 76 minutes/day, a 66% reduction. Get booking data 1 day earlier; improves planning of shipment.</i>	With visibility into in-transit, order/supplier events and trade document status, 78% of companies are able to easily access data needed for decision-making. <sup>ii</sup>
		<b>\$173/day</b> (forwarder report preparation and distribution center priority shipment processing); <i>28 minutes saved airline research and 178 minutes saved in preparation of DSR, a 50% savings. Booking data available 3 days sooner.</i>	
	Service Quality	Broker could prepare documentation on Sundays and process <b>18% more shipments</b> each week.	Dow Chemical reported a <b>50% reduction</b> in the time to identify and research in-transit problems as a result of visibility technology implementation. <sup>iii</sup>
	Data quality and availability	<b>\$11/day</b> in shipper time saved researching priority shipments; <i>based on savings of 27 minutes per day.</i>	44% of respondents do not have online visibility into trade document flow and 36% are planning to enhance their current capabilities in this area. <sup>iv</sup>
Robust XML messages based on automated event data (ex. ASN)	Productivity	<b>\$24/day</b> (at the Container Freight Station -CFS) for less error correction research; <i>6% fewer errors at \$4/error.</i>	Time savings were achieved in Export Documentation compared with phone, fax, and Excel spreadsheet. "Can do them all in one place." <sup>v</sup>
		<b>\$16/day</b> (CFS) for reduced EDI error correction; <i>calculated at \$3/error.</i>	
	Data quality and availability	CEFM Advanced Shipment Notice (ASN) available <b>6-8 hours</b> sooner than EDI ASN ASN received by <b>all partners</b> (pre-CEFM only a few partners received the EDI message) Improved availability of robust messages <b>reduced the number of trips from the warehouse floor to the office</b> to investigate missing or incorrect data. Current EDI accuracy at CFS is 65% whereas <b>EFM messages were 90% accurate or better.</b>	
Automated messaging (status messages)	Productivity	<b>Reduced</b> info exchanges from 22 to 16 exchanges in CEFM 15 manually-initiated exchanges vs. 2 in CEFM	Alerts to late or delayed shipments were <b>very important</b> to 47.8% of survey respondents, making it the most critical capability in achieving better efficiency and effectiveness in operations. <sup>vii</sup>
	Data quality and availability	<b>10% improvement</b> in data availability on warehouse floor (ASN); <i>allows better staff planning and forecasting of workload.</i> <b>100% improvement</b> in direct, near real-time airline status information. Previously, the forwarder had to research the information and provide it in manual status reports; <i>on demand status reports available sooner and more accurately than manually prepared reports.</i> <b>Eliminated</b> need for re-keying of data, so fewer data entry errors; <i>quicker response to shipment discrepancies.</i>	

- i. Capgemini Survey Results, *The Logistics Playbook*, Page 16, 2007.
- ii. Aberdeen, *Beyond Visibility...* Figure 3, page 8, September 2008.
- iii. Dow Chemical conference presentation and conversation with authors, October 2008
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## ANTICIPATED BENEFITS OF KANSAS CITY ADOPTION OF EFM

As described earlier, the Kansas City team's priority is measuring the impact of EFM's improved data quality and availability on operational productivity and service quality. Their goal is to monetize operational metrics and calculate EFM's ROI for the case study supply chain. The Kansas City case study will use EFM for all shipments during the several month deployment, a combination of coverage and duration that should make it easier to assess EFM effects. The Kansas City team also has a significant advantage since most case study metrics are collected now in the normal course of business; this will simplify baseline identification and EFM impact assessment.

The collection and use of these metrics is important as the USDOT executes the Kansas City and future EFM case studies. These case studies and the benefits documented from them seek to validate the benefits identified in the CEFM deployment test and those documented in frequently prepared surveys such as those generated by Aberdeen and Capgemini.

### *Productivity Improvement*

Five of the nine metrics are quantitative measures of productivity, all of which will support ROI calculations.

- Faster asset turn time: EFM's more timely, accurate and available data on inbound containers and containers already available for processing should help warehouse management to increase efficiency in planning, unstuffing and returning containers to the ocean carrier.
- Lower demurrage payments: The team expects the improved quality and availability of visibility data from EFM to help reduce demurrage payments to carriers. Faster turn time achieved with better information will lead to better use of allowed free time and lower demurrage payments.
- Less management labor to monitor inbound shipments: Currently, managers check on inbound status when they become aware of in transit problems. EFM may provide three benefits in this area:
  - Improving the efficiency with which management staff obtains in transit status;
  - Reducing management labor-hours to resolve problem shipments. EFM's near real-time status data for all shipments should allow quicker identification of and response to in-transit issues; and
  - Providing additional data such as the Customs Entry Number, which will allow better access to historical shipment information.

- Lower warehouse labor costs: The lack of reliable estimated time of arrival (ETA) information for inbound containers leads to over- and under-staffing of the warehouse with part-time labor. If EFM provides significantly better ETA information, managers will improve the match of labor resources and workload
- Better container capacity utilization: EFM's better visibility into operations at the origin may enable managers to increase container cube utilization, reducing transportation costs. This is the only new metric for the case study

In addition to these quantitative metrics, there will also be qualitative indicators in the areas of service quality and data availability/quality.

### *Improved Service Quality*

- Better inbound lead time reliability: In addition to supporting labor efficiency, delivery reliability is an important indicator of service quality in its own right.
- More optimal outbound order fulfillment: To the degree EFM helps improve reliability of container ETAs, it would also enable warehouse managers to better optimize outbound shipments to their customers. In the long-term, this could result in reduced outbound shipment costs.

### *Improved Data Availability and Quality*

- Improved accuracy of inbound shipment information: Currently, when a purchase order includes several containers that are loaded at the same time, the PO system requires each container to have a unique estimated receipt date. These estimates seldom match the actual arrival dates and may be several days off. Improved data accuracy would support several of the quantitative benefits.
- Improved frequency of data updates: Near real-time updates would be much faster than visiting web sites or making phone calls.
  - Better access to data: EFM in Kansas City will have a web portal so that less automated supply chain partners may provide and receive data more quickly, efficiently and accurately than before.
  - Improved use of EFM data: EFM in Kansas City will provide access to canned and *ad hoc* reports, improving users' access to archived shipment data. The reports would supplement EFM's current automated status and on-demand reports and enable better forecasting, such as shipment planning.

The Kansas City EFM case study has the potential to realize indirect benefits from other freight technology projects in the region. DOT supports the coordination of these efforts:

- Kansas City Trade Data Exchange (TDE): Like EFM, the TDE seeks to provide actionable knowledge to a variety of supply chain partners, including government entities like DOT and CBP. A key part of this initiative's five-layer architecture includes the automated transmission of shipping documentation, expected to accelerate transit time.

- **Kansas City Cross-Town Improvement Project (C-TIP):** This project aims to improve information exchanges among private and public stakeholders involved in truck travel in the Kansas City region. A software development effort, C-TIP includes the development of four applications designed to reduce freight congestion, provide real-time traffic information, improve equipment utilization and better support intermodal transfer planning.

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## CONCLUSIONS AND SUMMARY OF THE BUSINESS BENEFITS

While the Internet makes it much easier for sophisticated and unsophisticated firms and agencies to communicate, glaring gaps remain in supply chain related data quality—its timeliness, accuracy and completeness—and data availability. For example, less than half the firms in a large industry survey update even half of their supply chain data in a very generous definition of “near real-time:” 24 hours or less.<sup>31</sup> Further, data update performance is worse near the beginning of the supply chain than near the end.

Still, some companies have found profits in providing supply chain connectivity and collaboration tools. Some third parties have established networks to interconnect partners. An advantage of a network is the ability to add new partners quickly and easily. Joining can mean immediate connection with multiple partners. There are software and supply chain service providers who claim thousands of customers who are potential supply chain partners. Service-oriented architecture and Web services also can interconnect partners.

“Effective supply chain management is based on a firm’s ability to know the ‘what-where-when-and how’ of the flow of goods in real-time. This is the fundamental value created by visibility.”

Capgemini, 2008

*Based on case studies and industry research, we believe effective implementation of these technologies yields significant quantitative and qualitative benefits.*

The data from the September 2008 Aberdeen survey showed that 23% of those reporting benefits claimed more than \$3 million of supply chain business benefits.<sup>32</sup> Aberdeen also reported that experience with a project makes a significant difference: firms report the greatest benefits on projects underway for more than two years. Aberdeen’s data also support other conclusions that directly support the business case for EFM and other visibility technologies:

- Small and medium size companies may stand to achieve *more* benefits from visibility technologies like EFM – more than twice as many of these companies report benefits exceeding \$100,000 compared to those reporting breakeven or a loss.
- Automated means of data exchange (Web Services, EDI) contribute to a higher level of payback. Of companies that achieved financial savings through visibility technology:
  - 58% use automated means of data exchange with their suppliers
  - 39% use automated means of data exchange with their logistics providers
  - 35% use automated means of data exchange with their warehouses

*How industry quantified the savings as a result of visibility technologies is strikingly similar to the quantified metrics planned for in the EFM case study in Kansas City, including:*

- Asset utilization
- Amount of penalties/demurrage
- Labor costs

<sup>31</sup> Capgemini, *The Logistics Playbook*, 2007.

<sup>32</sup> Aberdeen Research Group, Analysis for SAIC and North River Consulting Group, “Supply Chain Visibility Software Benefits,” based on Aberdeen’s August-September 2008 survey.



## RESULTS IN THE EFM PROGRAM

The independent evaluation of the Columbus EFM (CEFM) deployment test documented meaningful dollar benefits, as reflected in Table 6. After computing individual savings, we normalized them based on the number of shipments that moved through the supply chain during the six month test period. This allowed us to calculate a total per-shipment labor savings of \$5.94.

*Since this savings per shipment total used Chinese (10.4% of the total savings) and Hong Kong (9.6% of the total) labor rates, we believe EFM savings per shipment would be higher for supply chains that originate in higher labor cost areas, such as Europe, the US or Japan.*

**Table 6. CEFM Quantitative Benefits**

Partner	Metric	Shipment Activity	Quantitative Benefit	Savings Per day	Savings Per Shipment
Manufacturer	Productivity	Book consignment (Chinese labor rates)	75% reduction in data entry	\$27	\$0.61
Forwarder	Productivity	Shipment pre-alert (Hong Kong labor). Daily status report (U.S. labor). Airline status research (U.S. labor).	65% reduction in labor for forwarder in HK. 50% reduction in labor for forwarder in Columbus.	\$187	\$4.61
Customs Broker	Data quality/availability	Customs processing (US labor)	18% improvement in weekly shipments processed by the Customs Broker	Not determined	
CFS	Data quality/availability	Error research Error correction (U.S. Labor)	6% reduction in errors at warehouse or \$4/error. Reduction of EDI errors and time to correct them; savings of \$3/error	\$40	\$0.92
Shipper	Service Quality	Research of priority shipments (U.S. Labor)	\$11/day saved monitoring priority shipments	\$11	\$0.25
<b>Total:</b>				<b>\$259</b>	<b>\$5.94</b>


Source: Adapted from CEFM Final Evaluation Report, May 2008

## CONCLUSIONS

- *There is a need for EFM and other visibility technologies.* Much of the literature we reviewed, especially annual surveys, reveal a gap in integration between supply chain partners. Although there has been progress over the last few years, many small and medium size companies still rely on fragmented, manual processes. Integration among multiple partners through EFM or other networks can directly impact the key supply chain business goal areas (productivity, service quality, shipment integrity). As Capgemini states in their 2008 survey, it is important to look at what ‘major players’ are doing that is significantly different from everyone else. Two of the key traits of major players are integration with their partners and greater visibility, both benefits of these technologies.
- *Data quality and availability provide the foundation to achieve core supply chain business goals.* Connectivity – one-to-one, many-to-many, and every variation in between – enables collaboration. Collaboration builds on connectivity and enables process integration which directly benefits all of the partners. EFM and related IT tools focus on data connectivity and collaboration by helping to improve data quality, especially in terms of accuracy and timeliness. Well-conceived and effectively employed EFM tools enable supply chain managers to convert data into useful information and then use it to enhance operational performance.
- *EFM and other visibility technologies offer deployment options for partners of varying technical sophistication and enable many-to-many communications that reduces or eliminates manual data entry and re-keying.* The range of technology solutions ensures there is a visibility tool that meets the needs of small, medium or large companies across a broad range of technical maturity. EDI can be expensive and complex to deploy, but larger companies may find it worthwhile. Web Services and SOA-based solutions can be deployed quickly, are easy to implement, and often rely on XML, which even ‘non-techies’ can work with and understand. Web Services are also compatible with EDI, making it a good solution for small companies looking to connect with their larger partners that may use EDI and for companies looking to quickly connect with multiple partners, some of whom may not use EDI. We found numerous web-based networks of commercial software providers that have hundreds or thousands of potential supply chain partners already interfaced with the network. This helps to add new partners to an automated supply chain information exchange.
- *EFM and other visibility technologies provide lasting benefits,* benefits which also impact companies’ response to increasing regulatory requirements. As Aberdeen illustrated, the level of cost savings from visibility technologies increases the longer the solution is in place: they noted a marked increase after two years of a technology deployment. Another lasting benefit is the ease with which companies can respond to changing regulatory requirements, such as the upcoming Customs 10+2 rule. Many companies will not be able to provide the needed data on their own. The technologies discussed in this report can help provide this visibility without sacrificing operational efficiency in the process.

The bottom line of this report is *broad industry research and reports and CEFM evaluation results reinforce each other and support the conclusion that EFM technologies and the EFM program can deliver significant business benefits.*

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<b>16. Abstract</b> Effective innovation in information technology (IT) may be the most important tool for the private and public sectors to respond to international supply chain capacity constraints and congestion. Electronic Freight Management (EFM) technologies are modern tools that, when well-implemented, offer dramatic improvements in the mix of one-to-one, one-to-many and many-to-many data transfer needs of complex supply chains. They enhance the speed, reliability and accessibility of data transfers and translations. The technologies include one-time data entry; architectures and tools enabling near-real-time dissemination and exchange of data; varying degrees of integration with Enterprise Resource Planning (ERP) and legacy systems; and web-based services for near-real-time access to actionable information. In 2007, as part of its Electronic Freight Management (EFM) program initiative, USDOT conducted an EFM deployment test in Columbus, OH with partners from a Limited Brands air cargo supply chain originating in China; an evaluation was completed and documented. Successful supply chain deployments of EFM technologies are delivering benefits along with more efficiency and better customer service. EFM and related visibility technologies provide lasting benefits. Major users of these technologies report better integration with their partners and greater supply chain visibility. This report presents results from many industry surveys and case studies as documented in the literature. With those as a backdrop, this report summarizes the quantitative and qualitative benefits found during the Columbus EFM (CEFM) test.			
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