Standardization of E-Commerce Transaction Documents and Product Classification Codes: Industry Impact Analysis

Introduction and Executive Summary

The purpose of this white paper is to help senior executives in the metals industry (mills, service centers) understand some of the potential business benefits of information technology as applied to eCommerce. To accomplish this, we review situations in industries that bear similarities to the metals industry either in structure, or in application and desired result.

We will draw parallels when appropriate and have made attempts throughout the research to derive as many "hard" figures on value and cost as possible. Nonetheless, we begin with the caveat that the role and function of IT driven eCommerce in the metals industry has yet to clearly materialize at an industry level. This white paper will discuss some of the key issues around eCommerce in the metals industry, particularly as it pertains to mills and service centers, as well as some discussion of possible links further downstream to the OEM level.

We focus on two elements of eCommerce:

1. Product code standardization to streamline information management
2. eCommerce related documents to improve transaction efficiency

We will also suggest how eCommerce can be of use in the metals industry and develop some high level guidelines around how best to drive implementation.

Metals Industry Background

The two primary entities of interest in this white paper are mills and service centers. However, the ultimate objective of any eCommerce initiative is to streamline as much of the supply chain as possible, so at some point OEMs and other end-users become a relevant

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element of the broader discussion. Figure 1 below illustrates a general snapshot of the metals industry supply chain.

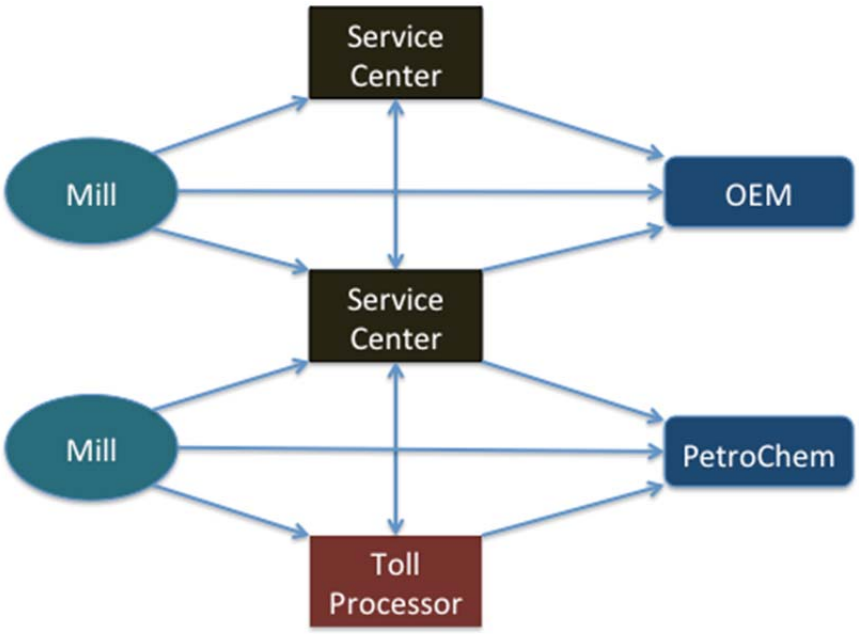

Figure1: Possible Supply Chain Relationships

Traditionally, service centers engage in two broad sets of revenue generating activities:

- Transactional bulk-breaking and value-added sales of mill produced metals
- Long-term customer/OEM relationships involving some form of value-add

While these business activities are not always cleanly separated, nonetheless we project it will be helpful to draw a distinction in order to understand where IT/eCommerce provides the largest potential contribution.

Transactional Distribution: Bulk-Breaking and Value-added Sales

The type of transactional distribution activity evidenced in the metals service center industry typically consists of carrying significant inventories of logistically burdensome products, which firms attempt to move at a premium to the original purchase price within a reasonable timeframe, with customer satisfaction being dependent on service levels. Our general understanding of the service center business indicates that companies participating

in this process regularly commit working capital amounts in excess of 50% of their firm value towards metals inventory for their transactional operations. Orders for service center stock may be placed well in advance of production and delivery by the mill. Once the stock is delivered, the service center takes ownership of the stock and then proceeds to find customers to buy the product in various degrees of modification (or value-add).

Customer Management: OEM Relationships

Many service centers manage key customers, or accounts, that can represent a significant fraction of their revenues. These customers reside in diverse industries such as automotive, aerospace, defense, construction, energy, petrochemicals, etc. Many service centers engage in value-added services such as machining, fabrication, kitting, etc., to service these types of customers.

While these relationships can provide stable and reliable business, they often arise through competitive bidding processes (RFPs) and come with restrictive terms, audits by the customer, and stringent requirements that potentially drive up costs, which reduce returns. Additionally, many large customers, particularly in industries such as automotive, will write-in contractual price reduction obligations, which typically fly in the face of the basic economic phenomena such as normal inflation. These basic dynamics result in assuring margin erosion over time, which impedes service centers' ability to drive adequate profitability at the account-level.

Potential Value of eCommerce to the Metals Industry

To assert that IT and eCommerce add value to any business operation is simplistic and overly general. While the current state of business in general indicates that technology can have profound impacts on a variety of levels, there is value in attempting to specify where these impacts are potentially most significant from the viewpoint of expected costs and realizable benefits. This understanding begins with a conceptualization of how IT and eCommerce fit into the broad picture of a company's business operations.

In any supply chain, intermediaries play a critical role in getting product to market, and also have an appreciable role in driving various supply-chain inefficiencies. Given this observation, coupled with the primary business function of service centers, there are two potentially interesting applications of EC and IT that could impact the growth and profitability of the various players in the industry:

- Application of IT/ eCommerce as it pertains to the commercial activities of MSCs (metals trading and customer management);

- Application of IT/ eCommerce as it pertains to the supply chain as a system, in order to mitigate perceived demand amplification and subsequent issues such as erroneous upstream forecasting, SKU proliferation and excessive stock positions.

IT/eCommerce to Enhance Commercial Activity

As noted earlier, we decompose a service center's activities into two broad categories of operations: metals trading, and long-term customer relationships. Table 1 below provides a snapshot of what we see as the significant features of these business lines and the relevance of IT/eCommerce to each.

Table 1: Service Center Business Activities and Potential IT/eCommerce Relevance

Transactional Distribution	Customer Management
• Sales Intensive • Service Driven Customer Satisfaction • Capital Risk on Inventory • Opportunistic Selling	• Stable Cash Flow • Contractually Obligated Price Reductions: Margin Compression • Customer-driven Process Audits
<u>Possible IT/eCommerce Initiatives</u>	<u>Possible IT/eCommerce Initiatives</u>
• Exchanges & Market Making Activities	• ERP-to-ERP Supply Chain Linkage

In the context of metals trading business, there are well-documented examples of exchanges and markets created by third parties in attempts to enhance transactional volume and efficiency. We use the lumber industry as a means of exploring the potential effect of exchanges and markets on industry players. Our initial conclusion is that e-markets and exchanges need to be carefully managed if created value is to be preserved within the industry.

The challenge in long-term relational situations is to manage the overall cost-to-serve (SG&A allocated) of the customer to levels that render a positive profit from the customer despite the overall gross margin dynamic. One potential application of eCommerce is to drive the costs of managing long-term relational customers down to a level that maintains, or grows profitability of the account over time.

With regard to customer management, there are industries that have implemented peer-to-peer solutions to improve communication and transaction speed, as well as to create outlets for incremental demand not traditionally available to the firm. There appears to be significant opportunity to utilize eCommerce for managing relational contracts. Market exchanges to enhance trading of metal SKUs, however, appears more problematic for a variety of conceptual, as well as practical, reasons. We will explore both of these options throughout the course of this white paper. Examples provided in the chemicals industry may prove useful in thinking through this application.

IT/ eCommerce *to Enhance Supply Chain Interactions*

Numerous eCommerce initiatives have focused on driving value through cost savings by streamlining supply chain interactions. The grocery industry, through its UPC initiative, provides an accessible example of how product code standardization can impact industry practice. The European textiles market also provides a situation in which both product standardization and e-documents for the order-to-cash cycle can be used to drive industry competitiveness and cost savings.

Document Description

The remainder of this white paper provides descriptions of IT/ eCommerce initiatives in four industries and contexts outside of metals, illustrates the derived benefits, lays out challenges and summarizes the key take-aways from the following four industry reviews:

1. Grocery Industry: Product code standardization
2. Chemicals Industry: ERP-to-ERP linkage for customer and vendor management
3. Lumber Industry: Private exchanges and hubs for efficient clearing of markets
4. Textiles Industry: Product codes and order-to-cash process standards for supply chain streamlining

E-Commerce Initiatives Reviews

Initiative 1: Uniform Product Codes (UPC) in the Grocery Industry

The North American and European grocery industries set best-practice benchmarks in product code standardization practices through their UPC initiatives. UPCs are a means of standardizing and effectively tracking product flows and inventories throughout the supply chain. Figure 2 presents a typical grocery supply chain.

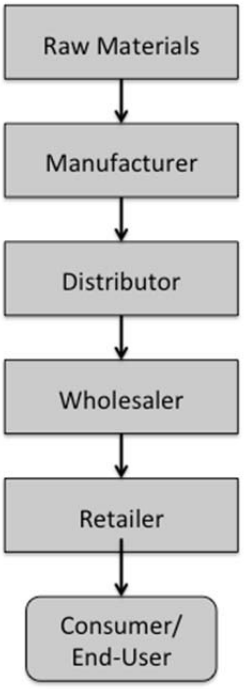

Figure 2: Typical Grocery Supply Chain

The general acceptance of UPCs enabled a number of other industry initiatives such as ECR (efficient consumer response) to reduce supply chain costs by more effectively balancing consumer demand and supply through standardization, refinement of business processes and liberal use of technology and e-commerce tools.

Realized benefits

Hard Savings: UPC implementation and scanner technology has been credited with significant industry benefits. For example:

- UPC implementation accounts for annual benefits of 2.8% of sales for the entire grocery industry, which is 3.5 times more than original projections
- 87% of grocery products are currently sold through the UPC system whereas original forecasts estimated a maximum of 15% utilization
- In dollar terms, the net hard savings in the entire industry exceeds $8 billion

However, the consulting firm PricewaterhouseCoopers estimates that total annual savings could be more than $15 Billion, which could be achieved through collaborative channel efforts throughout the supply chain.

Soft Savings: Non-quantifiable benefits of UPC implementation comprise at least five categories, each of which drive benefits that are currently difficult to measure:

- Automatic reorder
- Shrinkage (theft) control
- Improved warehouse operations
- Demand driven supply chain, inventory management/reduction
- Incremental revenue/sales gains

The savings are driven primarily through improved information flow. Industry experts suggest that UPC scanner generated data allow retailers and manufacturers to work collaboratively to save money through these "soft" benefits. Various studies conducted quantify the soft benefits of the UPC to be 2.9% of industry revenue. Soft benefits account for improved operations across the supply chain and use of information for category management, market and demographics analysis, etc.

<u>Untapped Potential and Current State</u>
At least some fraction of the industry value created was captured through service companies, such as A. C. Nielsen and Information Resources, Inc. (IRI), who provided technology and data management expertise. While scanner technology enabled the capture of consumer purchase data at the point of sale, the majority of channel members had no capacity to capture, store and analyze these data. Companies like Nielsen and IRI, working as information consultants, were instrumental in collecting and processing the data coming from retailers into marketing information that could be used to improve operations, sales and merchandising for the industry.

The irony within the success story of the UPC lies in how much more could have been achieved had the industry worked more collaboratively. The original implementers in the grocery industry, evidently pleased with the gains in efficiency they achieved, were less than aggressive in pushing the limits of UPCs.

The information tracked through UPCs and the potential for streamlining and consolidating execution practices were ultimately exploited by a new wave of "big-box" retailers (e.g., Wal-Mart) who ultimately outperformed, and outgrew, traditional grocery players. These players

were rapid adopters and innovators in their utilization of the technology and eventually surpassed traditional grocery players in growth and P&L performance.

Thus, whereas power within the grocery industry traditionally rested with manufacturers, the growth and scale of mass-merchants eventually shifted market power from manufacturers to the intermediaries. It is not uncommon to find branded manufacturers of consumer packaged goods who rely on "big-box" retailers for up to 40%-60% of their total sales. Manufacturers reliance on their channel to provide volume (and utilization of capacity) has driven a fundamental power shift in this industry. In this manner, UPCs contributed significantly to the shifting dynamics of the grocery industry, as well as arming certain types of players to gain dominance in the market.

UPC Development and Implementation

Bar codes were pioneered in 1932 by Wallace Flint (at Harvard Business School) and UPCs were developed by McKinsey & Co through an engagement with the Uniform Grocery Product Code Council (UGPCC) in 1970. The first UPC scanners were implemented by Marsh Supermarkets in 1974. A pack of Wrigley's chewing gum has the distinction of being the first item ever scanned. The results of UPC implementation were industry-wide productivity enhancements, information exchange, tracking, price control and cost control. Estimates vary, but figures such as $17 billion industry-wide monetary benefits stemming from UPCs are not uncommon. Despite these savings, consultants and industry experts suggest that the full potential of UPC codes has yet to be realized for the grocery industry.

Adoption Process

During the 1960's many grocery chains & manufacturers made efforts to utilize bar code and scanner technology to improve operations and flow of product within their supply chain. Some partial success was realized through vertical adoption of technology, but it was difficult to create scanners that would read multiple bar code symbols and formats. Key industry players foresaw that the significant benefits resulting from these efforts could be realized through the standardization of the bar codes, scanner data and industry-wide adoption. The UGPCC understood that the goal of scanning technology would not only be to optimize checkout scan systems, but also to provide information for retailers, manufacturers and other players in the supply chain to help optimize system dynamics. The foundational elements of the initiative effectively accounted for the interests of retailers, distributors and manufacturers in an integrative way. This resulted in voluntary industry-wide standardization.

Implementation Challenges

The adoption of technology within the grocery industry was by no means a foregone conclusion. The industry was checkered with issues of low trust between players and adversarial relationships both vertically and horizontally.

1. Costs-Benefits of Implementation: The first challenge facing the UGPCC was to determine whether the implementation costs of a UPC system would be offset by the resultant savings. A business case was prepared and economic impact on affected parties was documented. Potential areas of savings were broken down based on quantifiable benefits (hard) and perceived (soft) benefits. It was obvious that the economic benefits would be realized only if UPC adoption was widely implemented.
2. Technology Components: With technology rapidly changing, there were concerns centering on the ability of multiple players to adopt the system and the technologies it required. Partial adoption would likely fail to generate the projected gains. There were concerns whether the cost of adoption could be prohibitive for smaller players.
3. Organized Labor Concerns: Since the chief selling point of UPC codes was increased productivity, the unions typically felt that the adoption of UPCs and standardization would lead to job losses. Thus, unions worked to impose rules in an attempt to preserve their members jobs. Unions also delayed UPC implementation by lobbying for passing pricing legislation in some states.

Reasons for success

The grocery industry's UPC implementation has been far more successful than any other standardization or industry wide initiatives. Various studies have identified the following reasons for this success:

1. The implementation push came from within the industry rather than regulatory needs, which motivated faster adoption.
2. The planning committee framed the entire initiative into code and symbol decisions. The savings based on UPC code implementation were easy to quantify and got immediate support. Once the UPC code was standardized, the decision was made to pursue scanning technology and bar code symbols.
3. The business case was based on conservative and immediate benefits rather than long-term futuristic benefits. The committee focused on direct cost savings in terms of labor savings, productivity improvement, and price marking benefits and then derived hard savings that could result. Benefits from improved information gathering and flow, such as better inventory management, etc., were deeply discounted and classified as soft benefits.
4. The committee recruited enough retailers and manufacturers to ensure minimum critical mass required for successful adoption of the technology.

Key Takeaway: Grocery and UPCs

Product code standardization and implementation will generate a wealth of information that can be used to drive efficiencies and business practice changes. In the grocery industry, these informational advances gave rise to a new class of intermediaries (mass merchandisers) who eventually consolidated supply chain power and fundamentally altered the grocery industry's competitive landscape.

Initiative 2: eCommerce and Process Standardization in the Chemicals Industry

The chemicals industry provides an example of transactional process standardization that streamlines the order-to-cash cycle, as well as a variety of other supply chain interactions. In this section, we will examine the chemical industry's "Elemica" transactions processing initiative.

Industry Background

The chemicals industry consists of companies engaged in the processing and refinement of agriculture and industrial chemicals as well as gases. Chemicals are widely used in agriculture, manufacturing, construction, consumer goods and service industries. The European Union houses the world's largest chemical companies followed by the U.S. and Japan. As a whole, the chemicals industry is one of the largest and most diversified industries in the world, with worldwide sales estimated at $2,490 billion in 2007 (Kearney, 2009). In one way or another, this industry supplies 95% of all other industries. The chemicals ecosystem is generally divided into five segments: Chemical/Petrochemicals, Basic Chemicals, Specialty Chemicals, Chemical Distributors and Chemical End Users. Figure 3 illustrates the general supply chain of the industry:

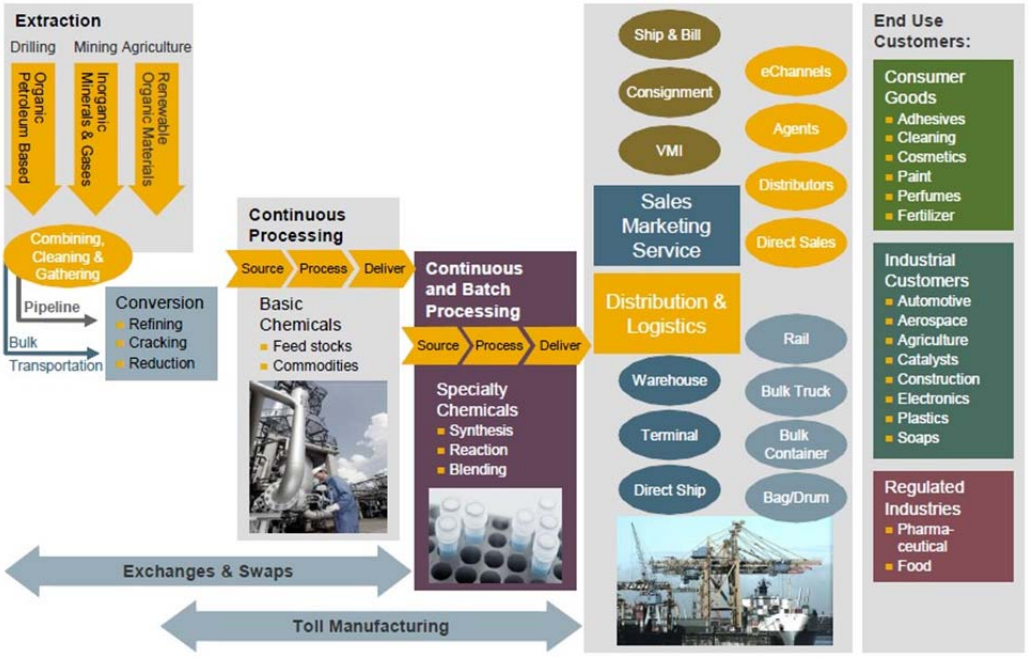

Figure 3-Chemicals Supply Chain

Source: (Rasool)

Despite the maturity of the industry, no single company dominates with a high percentage of share or output. For example, even with annual sales over $30 billion, Dow accounts for approximately 2% of global output. The top ten global companies only account for 16% of the total market, with several thousand other companies accounting for the rest.

The industry spans a vast array of market segments and a multitude of product lines. Most large companies operate in one or more segments, while numerous specialized operators exist in niche segments (Kearney, 2009; Liveris, 2002). In an industry demonstrating this level of fragmentation, even the specialty products and fine chemicals are generally sold to other companies as raw materials used to produce their final products. Approximately half of chemical industry output is purchased by businesses, which then create the finished consumer products. The other half is repurchased within the industry for secondary manufacturing, or value added processing (Liveris, 2002). This gives the chemical industry a unique feature in that much of the ongoing trade is with other entities within the same industry. As a result, customers are often competitors, and vice versa, to an extent dependent on company specific factors such as the degree of vertical integration, etc. Intra-industry sales within the US chemical market represent $184 billion, thus offering a significant opportunity for establishing broad-based industry alliances and collaboration.

Upstream players in this industry also face significant cost-driven pressures to consistently increase raw material price. On the other hand, chemical companies also experience counterbalancing downstream pressures to hold prices down due to declining/depressed spending power within an unstable global economic environment. On average, cost of goods sold (COGS) accounts for 78% of industry revenue. The thin gross margins that result force chemical enterprises to refine and optimize their procurement and supply chain processes in order to remain globally competitive.

<u>Industry e-Initiatives: Elemica transactions processing</u>

The Dow Chemical Company, along with other companies throughout the industry, serves as an effective e-Commerce implementation example. Broadly, Dow uses multiple e-Channels to execute its strategic priorities and serve its operational demands:

- *Elemica*: Transactions processing “e-hub”
- *MyAccount@Dow*: e-Platform for key/large accounts
- *Omnexus*: Industry consortium for plastics sales
- *Dow e-Mart*: Internally managed contractual purchasing of materials and supplies
- *TradeRanger*: Externally managed industry consortium for contractual purchasing of materials and supplies
- *ChemConnect*: New supplier sources and price negotiation/cost-control
- *SciQuest*: Laboratory supply procurement
- *ZoneTrader*: Excess equipment supply management/disposal

These e-Commerce routes, and their relation to customer (sell-side) and/or procurement (buy-side) activities, are illustrated in Figure 4 below.

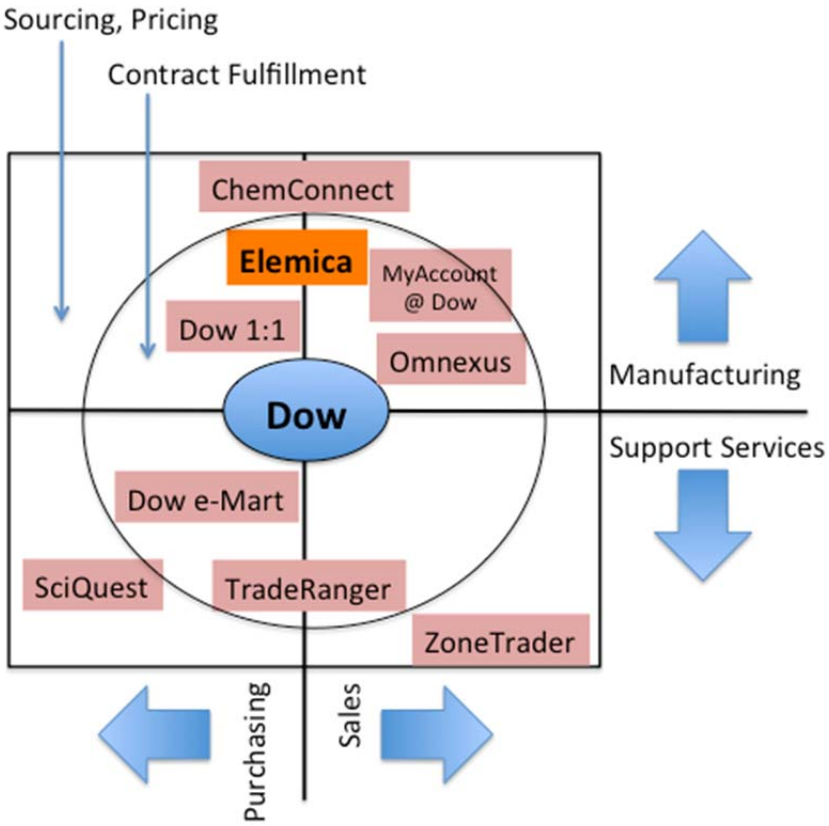

Figure 4-Dow Portfolio of e-Channels

Source: (Thomas H. Davenport, 2001)

Among these eCommerce channels, Elemica serves as a horizontal and vertical intermediary to help Dow manage chemical transactions with both vendors and customers. At its core, Elemica is a neutral information network built specifically for the chemical industry to facilitate order processing and supply chain management of contractual and repeated chemical transactions. It acts as a one-to-many ERP hub that allows a company to transact and execute everyday business with all other linked buyers and sellers who have already negotiated price or have contracts with each other. This ERP-to-ERP connectivity links each member's enterprise planning system to the hub and automates confidential transactions (Liveris, 2002).

Chemical companies had established computer-to-computer links prior to the Elemica initiative. However, these generally were considered too difficult and/or too costly to be useful in building meaningful e-linkages with cross business partners in an industry exhibiting such a high level of fragmentation. For example, in these initial attempts at

establishing computer linkages, complicated transactions could take up to 90 days of working capital to fully execute. To remedy these issues, Elemica was formed through a cooperative effort between 22 chemical companies as an e-hub to enhance connectivity and data integration between different companies. The initial investment to form the Elemica e-hub was $140 million.

Elemica: Value Realization

Figure 5 illustrates the Elemica's goal viz. the industry supply chain.

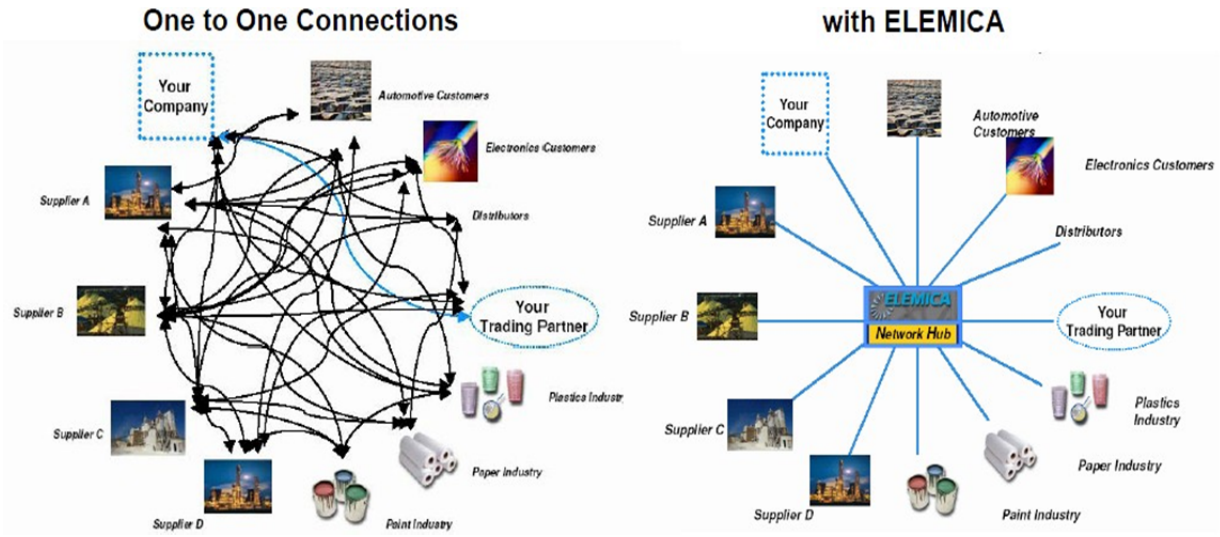

Figure 5- Direct ERP connections vs. the Elemica e-Hub Solution

Source: (Majumdar, 2008)

From an efficiency standpoint, Elemica reduced processing times and increased throughput. From an effectiveness standpoint, the e-hub reduced order errors, especially when compared with manual, or non-standardized forms of data entry. These improvements directly translated into cost savings for the member companies (Sectoral e-Business Watch, 2008). Value generated by Elemica came through the following areas:

Business Operations:

- Reduced supply chain costs
- Increased reliability and consistency of transactional information
- Gross margin improvement

Revenue Generation:

- Improved customer servicing, On-Time & Complete
- Reduced errors in processing and logistics
- 80% reduction in order entry time
- 20% reduction in change orders

Procurement:

- Increased supplier reliability
- Decreased procurement errors
- 30% reduction in safety stock
- 75% reduction in invoice errors
- 60% reduction in order processing time
- 50% reduction in payment processing time
- 20% reduction in invoice reconciliation time

Logistics:

- 98% reduction in logistics booking errors
- 4% reduction in delayed shipments
- 20% reduction in expedited shipments
- 87% reduction in truck waiting time

Financial Management:

- A/R-Lower outstanding receivables
- A/P-Invoice dispute resolution
- A/P-Manage days payable outstanding (DPO)

Penetration of e-Commerce standardization in the chemicals industry has progressively improved. For example, BASF utilizes both Elemica as well as its own global extranet platform, WorldAccount, to conduct e-Business using XML technology. Like Elemica, WorldAccount covers functionality from order placement, order status, e-reporting to access to certificates of analysis and MSDS materials. Together with WorldAccount, a total of 11.25% of BASF's global sell-side sales volume amounting to $5.2 billion was conducted electronically (eBusiness Watch, 2004). Elemica parters cite the following benefits:

Atofina: entire procure-to-pay process cycle time is reduced from 133 minutes per order to 24 minutes per order (BASF).

Celanese: a cost saving of $340,000 per year is reported from significant process errors reduction (BASF).

Rohm & Haas: 53% reduction of average inventory level is gained (BASF).

Dow: transaction cost has decreased and a 500% improvement is realized in transaction volume with suppliers over 2009 and positioned Dow as the leader in procurement transactions among all Elemica network members (Elemica, 2010).

Elemica: Standardized Order Process

Elemica, realizing that chemical companies were not likely to change-out their existing IT infrastructure in order to adopt new industry standards, chose to help its member companies communicate with one another while retaining their own ERP systems and

communication standards. The Elemica system was designed to translate orders from different ERP systems into a common vernacular that could then be re-translated into the language of the ultimate recipient. Elemica thus created a canonical IT/eCommerce model at a the chemical industry level, relieving individual companies of the burden of evaluating and adopting systems on an individual, one-off, basis.

As with all other e-Marketplaces, order management is one of the most critical issues facing Elemica. Received messages must be translated to meet the requirements of different ERP systems. Once a customer sends order information through Elemica, it stores and processes all the in-house manufacturing information in the transactors' ERPs. Through Elemica, they pass information regarding the order fulfillment to the appropriate suppliers' and customers' ERPs (Sectoral e-Business Watch, 2008).

Behind the order-to-cash framework, the order information Elemica receives can be in any type of ERP language or protocol. The message is translated and sent out in the customer's ERP language. Most chemical companies are EDI driven, thus Elemica then converts into ChemXML (Chem eStandards™), a widely-adopted communication standard in the chemical industry. Table 2 shows Elemica supported Chem e-Standards Message.

Table 2-Elemica Supported Chem eStandards Messages. Source: (Rehn, 2007)

Order Change	Financials
Order Create	Invoice
Order Response	Payment Detail
Price and Availability Request	Forecasting
Price and Availability Response	Delivery Receipt
Product Information	Demand Forecast
Certificate of Analysis	Demand Plan
Logistics	Inventory Actual Usage
Shipment Instruction	Replenishment Proposal Request
Ship Notice	Replenishment Proposal Response
Load Building Motor	Supply Plan
Load Tender Motor	Reporting
Load Tender Ocean	Product Movement Report
Load Tender Rail	Technical Acknowledgement
Load Tender Response	Receipt Acknowledgement Exception
Shipment Status	Receipt Acknowledgement
Receipt Notice	

Chem eStandards was developed collaboratively by subject matter experts from various organizations within the chemical industry, with the intent to develop an XML-based data interchange standard that is freely available for broad and appropriate use by all chemical industry participants. It is supported by the Chemical Industry Data Exchange (CIDX), which has now merged into the Open Applications Group, Inc. (OAGi), to maintain and facilitate these XML-based standards for chemical industry (OASIS). As a third party, OAGi's responsibility is to identify the set of transactions that require definition and standard documents to support the chemical industry.

Figure 6 depicts the electronic data flow in an order fulfillment process. All the transaction factors are included in the automatic process to streamline the order-to-cash cycle: requirement planning, purchase orders/sales orders, purchase order changes/sales order changes, order confirmation/acknowledgements, advanced shipment notifications and invoice generation.

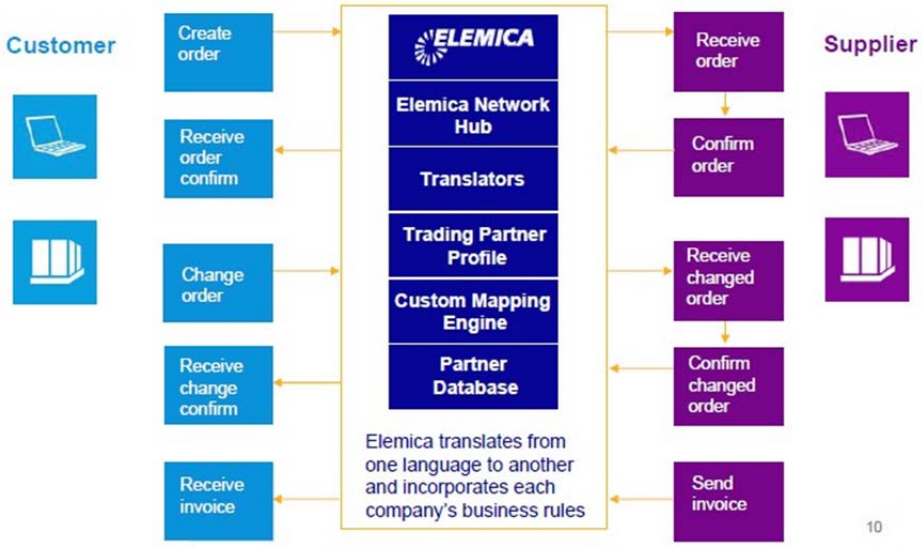

Figure 6-Electronic Data Flow in order management

Source: (Rehn, 2007)

Elemica's e-Business service portfolio includes three options covering both large companies running under ERP environments and SME's light connectivity.

- **Elemica Connected Solutions**: the major and most advanced type of connection, offering full ERP connectivity.
- **Elemica Buyer Direct**: a light integration between buyers and sellers, offering low cost e-ordering system via single connection to multiple partners. No ERP required.

- **Elemica Web Solutions – Elemica Seller Direct**: a technology bridge that allows a seller to receive and process orders from an ERP-connected buyer using a web browser interface.

Implementation Costs

- **Elemica Connected Solution**: Establishing a full Elemica integration typically costs a company between $15,000 and $30,000 (non-recurring investment). Actual costs depend on a company's existing IT infrastructure and business process complexity. Additionally, Elemica charges a $1,000 annual membership fee for incoming message integration.
- **Elemica Buyer Direct**: For $3,000, a company can purchase a license to utilize the Elemica Buyer Direct technology. An additional $1,000 membership fee is charged if the company adopts incoming message integration.
- Elemica is a self-supporting enterprise. Like other e-marketplaces and intermediaries, Elemica operations are financed through fees charged for each transaction conducted by members through the network (Sectoral e-Business Watch, 2008).

Key Issues

Elemica required the cooperation and coordination of 22 leading chemical companies in 2000. The Dow Chemical Company, being acutely aware of various supply chain inefficiencies, was the primary force behind the initiative. Most chemical companies were reluctant to accept the prospect of establishing e-connections with a large number of firms, given their past experiences with computer-to-computer linkages. The historical record indicated an unfavorable cost vs. benefit ratio.

Through interactions and dialogue with DuPont, Dow realized that DuPont also suffered from similar inefficiencies in their own supply chain environment, and that a well-populated 3rd party site for one-stop online transaction was desirable for both parties. Elemica, as a 3rd party vehicle, successfully attracted a wide range of significant suppliers that customers could efficiently access. Key learnings in the earlier adoption phase is summarized as below (Liveris, 2002):

- Choose an appropriate business model for the industry - the alliance or industry consortium.
- Forming alliances and e-initiatives are significant tasks. Equal ownership positions to all the founding partners and no "first mover" advantage served as the key point to accelerate adoption and integrate partners.
- Top executive commitment and involvement was critical in the formation process.

- Follow-up is needed post-formation. A business-by-business basis study was conducted once the alliance was established to measure and market the benefits of various service-line offerings.
- Offer data management and hardware/software expertise to new companies and early adopters.
- Time is the enemy: Speed of implementation is key.
- Listen to the customers and serve the broader needs, as opposed to those of a specific company or member.

Key Takeaway: Chemicals Industry

Offering IT system compatibility is success driver since it promotes easier adoption and critical mass. Large, or significant, industry players can have significant influence in motivating industry level adoption of systems and standards. Despite the influential nature of large players, impartiality (3rd party) and objectivity are key drivers of mass adoption. OAGi role is well noted in establishing Chem eStandards.

Section 3: Exchanges and Virtual Markets in the Lumber Industry

The US Lumber industry generates more than $100 B in revenue. The supply chain in this industry can be broadly categorized into the segments presented in Table 3:

Table 3: Lumber Industry Breakdown

Segment	Description	Financials	Fragmentation	Growth
Logging	Supply primary products such as softwood, hardwood logs, bolts, pulpwood & secondary products like bark and saw dust	Rev.: $13 B Profits: $3.0 B	High Top 4 players own 10% market share	Integration with timber based operation (downstream)
Sawmills & wood production	Manufactures preserved and unpreserved sawn wood from logs, mostly for manufacture of lumber, millwork and other wood products	Rev.: $ 24 B Profits: $ 2.0 B	High Top 4 players own 12% of market share	Upstream integration to control the factors that controls the supply
Wholesaling/ Distributing	Lumber wholesaling industry supplies timber products to contractors, retail chains and small retail outlets.	Rev.: $ 75 B Profits :$11.6 B	High Top 4 players own 15% of market share	Big retail chain directly contact manufacturers and bypass wholesalers

Figure 7 below provides a depiction of the lumber supply chain.

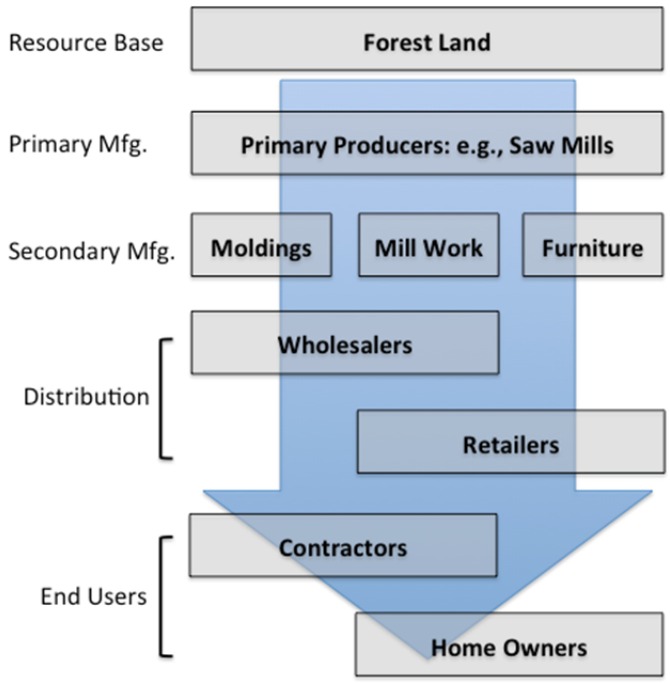

Figure 7: Value Distribution Chain for Lumber Products

The industry depends heavily on the construction and housing industries for demand and experienced deep challenges arising from the steep declines in real estate beginning in 2007. There have been several studies conducted to help understand the usage of "electronic data interchanges" for the lumber industry. Most of the companies in this industry continuously look for new and better ways to speed communication between trading partners and create value for customers in order to gain a competitive advantage.

One survey conducted, across approximately 1000 lumber industry companies, indicated that many lumber related companies primarily seek to improve communication speed and quality with trading partners, and create customer value as the primary reasons for pursuing eCommerce related strategies (Richard Vlosky, K. P. (n.d.)).

The study also examines the perceived benefits because of e-commerce adoption in the main-stream lumber industry. The industry claims that there has been substantial help in information flow between vendors, supplier and other players in the industry. Table 4 exhibits the likelihood of the benefits for the surveyed participants.

Table 4: Benefits of eCommerce Adoption in Lumber, Survey Reponses

Source: Richard Vlosky, K. P. (n.d.)

	Information	Cost/ Service	Current Customers	Potential Customers
Increased access to industry	85%	26%	22%	24%
Timeliness of information	81%	21%	24%	20%
Lower costs of doing business	24%	83%	21%	15%
Fast Delivery	14%	75%	26%	20%
Lower prices to customers	32%	59%	8%	20%
A preferred way to sell products	15%	56%	49%	14%
A lower cost to promote my	36%	51%	30%	39%
Increased value to my customers	35%	29%	76%	30%
Increased customer retention	29%	30%	76%	26%
Increased service to customers	32%	49%	53%	32%
Greater exposure to potential	53%	17%	32%	67%
Greater excess to my company	50%	19%	36%	66%
Increase sales for my company	41%	28%	47%	58%

<u>E-commerce initiatives for lumber supply chain:</u>

In general, technology adoption in this industry has been relatively low. While computers and new communications technology are present in this industry, the penetration of IT systems and eCommerce initiatives has not been as prevalent as in the grocery or chemicals industries.

The lumber industry material flow is generally characterized by divergences due to the large variances in quality and dimensional variability generated by manufacturers for the subsequent levels in supply chains like agents, wholesalers/retailers or direct consumers. Additionally, there is interdependence among the manufacturers of different products. eCommerce offers a wide range of opportunities for improving the logistics and information exchange of products.

It has been generally observed that the technology adoption in the lumber industry has occurred upstream in efforts to streamline raw material flows. There are examples of electronic data interchange relationship between different players within the supply chain. These exchanges can be classified into following different models:

1. **Vertical Industry exchange:** A data interchange designed to be the most operationally efficient setting across the entire supply chain. For example, PaperExchange.com and PaperX.com were independent for paper vertical of the forest industry. TimberWeb.com is the global lumber exchange marketplace.

2. **Trading Hubs:** These are platforms where buyers and sellers converge to electronically transact goods, services, business documents and information. This helps streamline the routine transactions through standardization. By leveraging a single connection participants can manage business messages, obtain accurate and real time information and enhance relationships with hub participants.

3. **Supply Chain Collaborative platform:** This is an exchange model established between partners to share information and optimize product development and supply. One example of a collaborative platform is the VMI relationship between Home Depot and Camfor Corporation, which manages lumber supply for all Home Depot distribution centers. VMI not only helps Camfor serve its customer better, but also enhances demand forecasting and inventory management.

4. **Auction Sites:** Auction sites act as spot markets where players remain anonymous and share information and reveal their identity once the business deal is confirmed.

There is a widespread consensus that these types of exchanges improved efficiencies through the transparent exchange of information. During the early 1990's, many **private investors** viewed the opportunities and pursued ownership of some of these exchanges. With informational transparency, the margins eroded and the markets became more competitive. Exchanges are the obvious beneficiaries of the margin erosion, which contributes positively to exchange P&Ls.

Viewing these privately owned exchanges as competitors, industry players came together as associations and launched **many industry owned exchanges**. These exchanges were based

on equity share ownership and were considered more sustainable in that while margins would still face pressure, the generated earnings would still remain within the supply chain. This helped the industry standardize various processes like RFQs, negotiations, purchase orders and other transactional contracts. This also provided a platform for some of the smaller players in the industry to level the field with the bigger players of the industry.

Still other exchanges, **owned by an individual buyer or seller,** proliferated within the industry. These exchanges were considered to be an offset to looming antitrust issues stemming from the resultant industry concentration. However, individually owned exchanges were not as efficient as the industry-wide systems. The benefits of transaction standards and information sharing were classified into revenue enhancement or cost reduction:

Benefits for Revenue Enhancement:

1. Expanding market reach: new markets, market penetration and better supplier – buyer match.
2. Increased market velocity because of shorter order cycle due to information visibility
3. Improved customer service.

Benefits for Cost Reduction:

1. Operational efficiencies: reduced sales cost, reduced inventory, low cost to individual EDI network, collaboration and visibility.
2. Scale and spend aggregation: economies of scale and increased leverage in negotiations.
3. Reduced order process cost by automation and cheaper mode of communication

<u>Industry wide initiatives challenges</u>

Challenges and impediments to the adoption of e-Commerce in the lumber industry are detailed below:

1. **Liquidity:** For industry wide implementation of exchanges and hubs, a significant challenge is to generate consistent liquidity. Consistently adequate liquidity results only if sufficient numbers of players commit to be part of the initiative to ensure adequate threshold transactional volume.

2. **Adoption Rate**: It is imperative to have a minimum adoption rate among industry players to ensure that sufficient information is flowing in the standardized format to realize the benefits.

3. **Commitment**: There needs to be a commitment from all the players to conduct business through the industry wide adopted mechanisms in order to generate centralized benefits. Sometimes, organizations develop the best practices to ensure maximum profitability, but then start operating separately to gain control over information.

4. **Sharing of the pie**: In most of the e-commerce initiatives, the realized benefits are transferred to the customers because of increased competitiveness and information transparency. This happens once there is streamlining of demand, material costs, RFQ and negotiating processes. To retain some of the profits, many associations also decided on product pricing limits to ensure that the players don't indulge into price wars.

5. **Customer relationship**: From the supplier's perspective, e-Commerce redefines the supplier role as a virtual source of goods.

Post Implementation Results:

The outcomes of these initiatives were not all positive for the lumber industry. At least anecdotally, it seems much of the value created by exchanges was captured by the exchanges themselves.

Various industry surveys were conducted to compare the perceived vs. actual results after implementation of the initiatives described above. Some summary points regarding the above eCommerce initiatives from these surveys are:

- Customer retention improved
- Competitive intelligence improved
- Direct contact between buyers and suppliers was reduced
- Cash flow deteriorated
- Profitability was reduced
- Data accuracy remained the same
- Errors rates were reduced
- Cycle times were reduced
- Needs arose for business process restructuring

Key Takeaway: Lumber and Exchanges

While electronic markets and exchanges dedicated to clearing excess supply are theoretically attractive, the potential exists to erode margins and degrade pricing in a manner that is damaging to the industry base.

Section 4: Supply Chain Streamlining in the European Textiles Industry

The key challenges facing the European Union (EU) textiles/apparels sector stem primarily from low-cost Asian competitors. The successful implementation of e-Commerce initiatives offers the potential to reduce costs and restore competitiveness for EU sourced textile products. Most companies in this sector utilize standard software packages or ad-hoc developed solutions for eCommerce. IT solutions (such as e-marketplaces or online trading platforms) offered by Application Service Providers (ASP) are less common.

TEX-SPIN (Textile Supply-Chain Integrated Network) is a major EU-based e-Commerce initiative promoted by the European Committee for Standardization/Information Society Standardization System (CEN/ISSS) and EURATEX. TEX-SPIN works to provide a framework and standards for the integration of the European Textile/Clothing/Distribution chain.[2]

Overview and Supply Chain Description

Textiles and apparel comprise a highly diversified industry containing groups of related industries that use a variety of natural (cotton, wool, etc.) and/or synthetic fibers to produce semi-finished and finished fabric. This industry significantly contributes to many national economies, encompassing both small and large-scale operations worldwide (e-Business Watch, 2005). One representation of the basic manufacturing flow is illustrated in Figure 8.

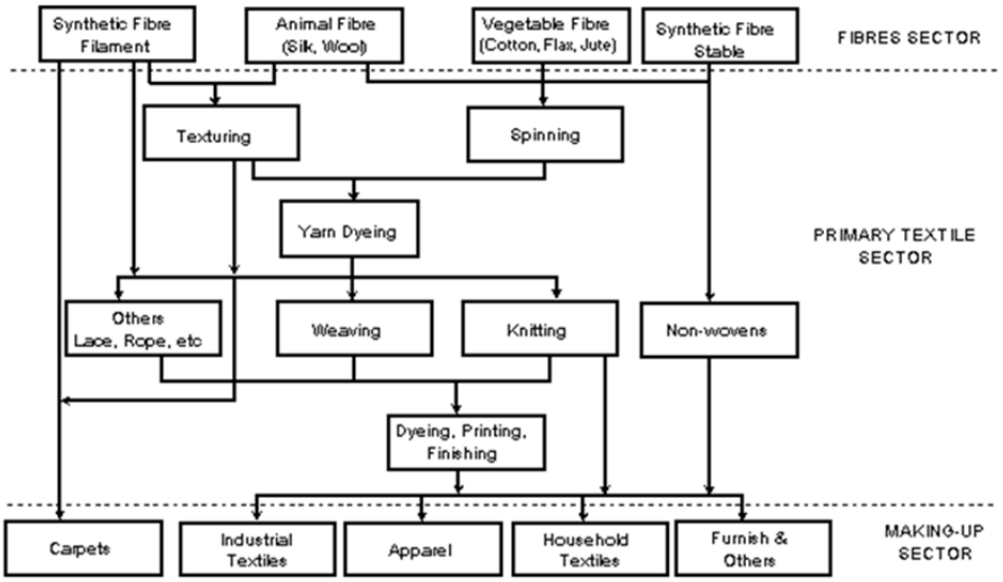

Figure 8 – Textile Industry Supply Chain

[2] Moda-ML and eTeXML are the two foundations of TEX-SPIN, where Moda-ML is a project based in Italy and focused on upstream manufacturing integration and eTeXML is a project based in France and focused on downstream link between manufacturing and retailing. The upstream priorities include the efficiency and richness of data as well as the flexibility of product description, while the downstream focuses on the efficiency of data exchange, normalization of product description and compact messages and universal coding.

Upstream textile manufacturers tend to utilize automation and technologically advanced machinery, while the more labor-intensive clothing manufacture is performed by smaller firms. Labor cost is a fundamental driver for the economics of this sector. The industry exhibits a high degree of fragmentation. For example, in the European Union apparel subsector, small and medium sized enterprises (SMEs) account for 60% of the workforce and produce almost 50% of value-added. SMEs play a central role in the industry supply chain providing high levels of specialized capacity as well as flexible manufacturing and production. Figure 9 illustrates the supply chain for this industry.

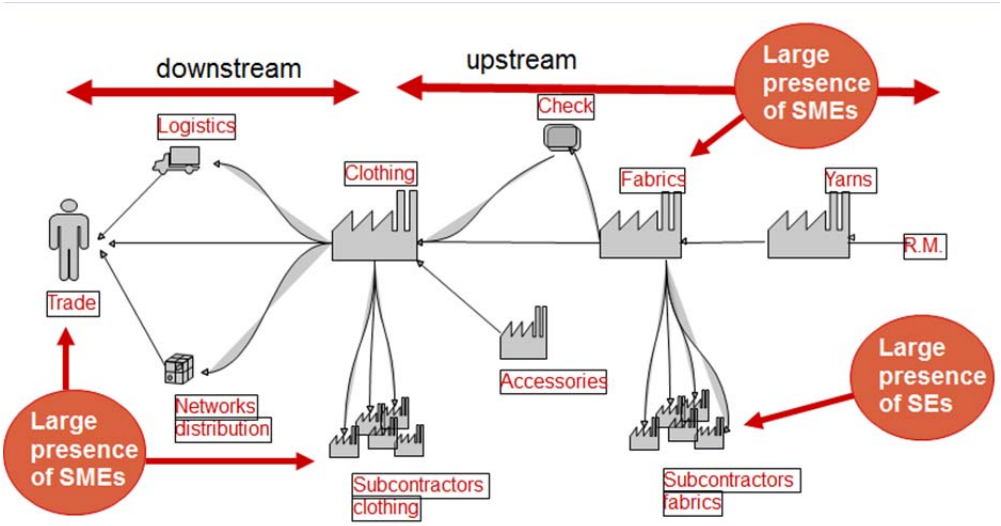

Figure 9 - Textile and clothing supply chain

Source: (Sabbata, 2003)

Each productive, value-enhancing activity involves a network between suppliers, third parties and customers. These networks tend to be highly relational. Performance (e.g., response time, quality and price) is typically not measured or benchmarked, thus limiting efficiency across the value chain (e-Business Watch, 2005). Inter-company data flow is a critical obstacle for the supply chain responsiveness in this industry. With this as context, the following bullet list provides baseline requirements for the TEX-SPIN process:

- Interoperability requirements:

  Public, free, common languages and interfaces (standards)

- SMEs' requirements:

  Ease of use, free, modules to enhance their independent legacy systems (XML and related standards and tools)

- Intercompany relationships requirements:

  Many to many relationships and un-rulable by a single firm (consensus is needed)

- Confidentiality requirements:

  Architectures without commercial data on third party databases (peer-to-peer as well as ASP models)

TEX-SPIN workshops across multiple e-business initiatives were executed over a stream of projects and sub-initiatives that aimed to further harmonize e-business processes and data exchanges for SMEs.

TEX-SPIN Value Realization

Standardized transaction processes (as described later in this section), XML documents and product codes were exercised in pilot organizations under a TEX-SPIN sub-initiative called "eBIZ". The first phase contained four pilots: with one in the upstream textile/apparel sector, two in upstream footwear, and a downstream cross-border partnership. These pilots demonstrated the inter-operability between systems. Real data exchange was executed during a later phase of the project and involved broader participation across the sector. Major outcomes (economic and other) are summarized as below.

Qualitative Benefits

Benefits associated with the e-documents interchange include increases in efficiency through decreased operating costs and increases in effectiveness through reduced lead-times, response times and increased flexibility. For those companies new to electronic documents exchange, benefits are large and normally attained in the short term. Companies already using electronic documents exchange systems yielded benefits at a slower pace. Gains in order processing times are illustrated in Figure 10.

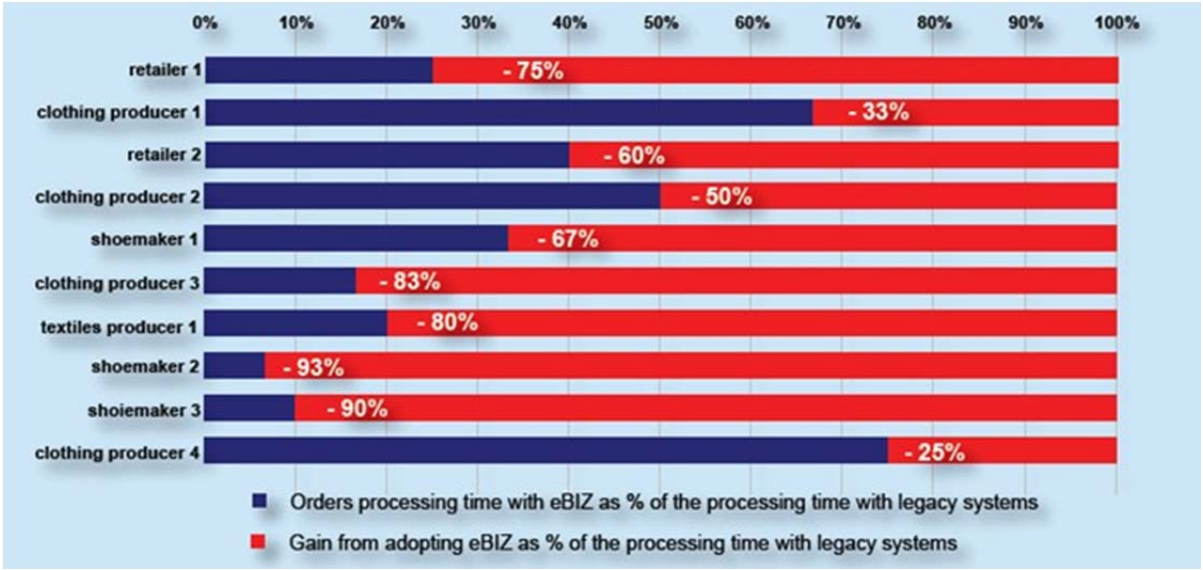

Figure 10 - Gains in order processing time in a sample of pilot participants

Source: (eBIZ-TCF, 2010)

Quantitative Benefits (Pilot Outcomes)

A Medium-large clothing company:
The TEX-SPIN compliant system managed approximately 30% of the customer orders and 10% of procurement orders. Order processing time improvements were approximately 80% for suppliers and 50% for customers.

Before: Exchanged order documents with a medium size textile company via fax/email
After:

- Approximately 100 days of realized labor (order manager) savings per year (at a wage rate of approximately $44/hour)
- Potential labor savings of up to 400 days per year, which amount to approximately $140,000 labor cost savings in one year, when all the orders between two companies were processed though TEX-SPIN
- Errors in order processing dropped from a 10% average to virtually zero
- 50% reduction in average response time for an order

A Small footwear company:
The TEX-SPIN compliant system accounted for only a small fraction of the overall orders of all the participants. Companies involved were very small and needed high levels of support to expand the number of suppliers/customers engaged.

Before: Exchanged order documents with a very small component supplier and sold to small chain of large surface specialized stores via fax/email
After:

- 90% order processing time saving
- Gain of 10 labor (order manager) days in one year
- Potential gain of up to 380 labor (order manager) days per year, amounting to over **$**63,000 labor cost savings in one year (at a wage rate of approximately $22/hour), when all the orders between two companies were processed through TEX-SPIN eBIZ
- Errors in order processing dropped from 10% to approximately 1%
- Average response time for an order was reduced by 50%

A Large retailing chain of independent stores:

The TEX-SPIN compliant system previously managed approximately 1% of the overall orders of the central buying organization. By 2010, 30% of orders were expected to be managed.

Before: Exchanged order and stock availability documents among the stores, the central buying organizations and the apparel producer via fax/email.

After:

- 75% order processing time saving in central buying organization and higher for the clothing supplier
- Gain of 220 labor (order manager) days per year, which amounts to approximately **$**36,000 labor cost savings in one year (at a wage rate of approximately $21/hour)

- Potential gain of 750 orders' manager days in one year, which amounts to $127,000 labor cost savings in one year, when all the orders between two companies are processed through the TEX-SPIN eBIZ system
- Average response time for an order dropped from a full day with long lead times to approximately 5 minutes

Key Issues

The implementation with pilot companies provide the following insights:

- IT providers were the key drivers of e-Business implementation, particular for small companies.
- The substantial reduction in software development costs is a key factor in driving adoption.
- Fast implementation is preferred, particularly downstream since, e.g., retailers are consistently impacted by short-term economic conditions.
- Different attitudes exist towards e-Business implementation. The technical IT personnel are the key, while most top managers only think in terms of sales and margins increase without understanding the details of implementation. A successful process requires deep involvement at both technical and managerial levels.
- For many companies, the qualitative benefits are of equal or greater value than the quantifiable benefits.
- Dissemination of the resultant gains would assist committed adopters in accelerating usage and full implementation.

Further details regarding the TEX-SPIN initiative can be found in the appendix.

Key Takeaway: Textiles and Supply Chain Streamlining
Measurable productivity gains are possible across a variety of firm types and sizes, as per the results of the eBIZ implementation. Actual labor costs associated with this style of implementation can be compared to implementation costs in order to determine actual ROI. External consultative support can be an important factor in facilitating participation and adoption.

Summary: Value Realization and Key Issues

In general, IT and eCommerce has had positive impacts on reducing cost, improving efficiency, reducing errors and streamlining supply chains. In each of the industries we examined, these benefits consistently surfaced in both qualitative and quantitative ways.

Most all initiatives focused on supply chain management in one way or another. Key account and customer management seemed most developed in the chemicals industry, particularly with the Elemica initiative. Table 5 below lays out a summary of the costs and benefits of IT and eCommerce in the four industries discussed throughout this white paper.

Table 5: Summary of Industry- and Firm-Level Costs and Benefits

Industry	***Cost/Investment***	***Cost Savings***	***Soft Benefits*** (Firm Level)	***Macro Effects*** (Industry Level)
Grocery	UGPCC and 3rd party development costs for UPC initiative undisclosed Firm Level: Scanner check out systems cost approximately $1500	Industry level benefits: • $8+ billion • Potential cost savings > $15 billion	• Automatic reorder • Shrinkage (theft) control • Improved warehouse operations • Demand driven supply chain, inventory management/reduction • Incremental revenue/sales gains	• Industry-wide productivity enhancements • Price erosion • Mass merchant proliferation and growth
Chemical	Industry level: (22 companies) initial investment - $140 million Elemica startup cost Firm level: Full Integration: • $15,000-$30,000/ $1,000 annual membership fee Light Integration: • $3,000 plus a $1,000 membership fee if the company adopts incoming message integration.	Firm level benefits: • Gross Margin improvement • 80% reduction in order entry time • 20% reduction in change orders • 30% reduction in safety stock • 75% reduction in invoice errors • 60% reduction in order processing time • 50% reduction in payment processing time • 20% reduction in invoice reconciliation time • 98% reduction in logistics booking errors • 4% reduction in delayed shipments • 20% reduction in expedited shipments • 87% reduction in truck waiting time	• Reduced supply chain costs • Increased reliability and consistency of transactional information • Improved customer servicing, On-Time & Complete • Increased supplier reliability • A/R-Lower outstanding receivables • A/P-Invoice dispute resolution • A/P-Manage days payable outstanding (DPO)	
Lumber	Initial investments made by private parties/ entrepreneurs to establish vertical exchanges and auction sites. Amounts undisclosed, but could range from $50MM-$100MM in startup capital costs.		• Standardized various processes like RFQs, negotiations, purchase orders and other transactional contracts • Competitive intelligence improved • Direct contact between buyers and suppliers was reduced • Customer retention improved • Error rates were reduced • Cycle times were reduced	• External, 3rd party, exchanges and markets created • Increased levels of competition • Margin erosion
Textiles	TEX-SPIN and 3rd party costs undisclosed	Firm level benefits: • Hard labor savings ranging from 100 to 200 days per year • Potential labor savings of up to 400 to 750 days per year depending on firm type • Quantifiable reductions in average order response times across a variety of firm types	• Increases in efficiency through decreased operating costs • Increases in effectiveness through reduced lead-times, response times • Error rates were reduced	• Improved industry level competitiveness on a global level

The key issues and challenges in implementing IT and eCommerce can be broadly categorized into the following areas:

- Startup costs: Who makes the required initial investments?
- Technology compatibility: What standards minimize new technology requirements and costs for participating firms?
- Critical mass: How will the necessary levels of participation and compliance with standards be attained?
- Labor displacement: Efficiency and cost savings generally come at the expense of displaced human capital. How will this challenge be addressed, particularly in organized labor environments?
- Value capture: Cost savings translated into price competition merely erodes value created and passes it downstream. How will these forces be contained so the initial technology/capital investments yield positive return?

The industries exhibited key successes and failures by the players within them. Table 6 summarizes these.

Table 6: Industry Successes and Failures in eCommerce Implementation

Industry	Successes	Failures
Grocery	Product standardization with high adoption rates and coordination at multiple levels of the supply chain	Lack of full exploitation of available information by incumbent players resulting in a new class of retail that eventually dominate the market
Chemicals	Coordination of e-hubs and marketplaces that manage both vendors and customers using a system that can link and translate between different IT infrastructures; Structured and contained company IT investments & membership costs	Selective adoption; Relatively low penetration rate of technology as compared with UPC/grocery adoption
Lumber	Effective third-party creation of spot markets and transaction hubs to clear excess inventories	Inability to capture the efficiency gains; bidding away of value and margin erosion
Textiles	Supply chain streamlining initiative that creates tangible value through labor efficiencies and cycle-time reductions	Selective adoption; Relatively low penetration rate of technology as compared with UPC/grocery adoption

Key Factors for Metals Industry

The two areas of exploration with respect to eCommerce in the metals industry are product standardization and e-Docs to streamline the order-to-cash cycle. Some key success drivers for any metals industry initiative to drive standardization and eCommerce are as follows:

- **Collaboration**: An organizing collaborative body appears to be a necessity, e.g., UGPCC in grocery, CEN/ISSS in textiles. As per the chemicals example, success of an e-initiative can be driven by collaboration between significant players within it provided they promote the interests of the broader industry.
- **Accessibility**: The prominent example supporting this success element lies in the chemicals industry. Elemica's open structure that allows different IT systems and languages to communicate with each other through a translation methodology significantly improves accessibility and removes a barrier to participation.
- **Security**: Information integrity and confidentiality are key factors in assuring accuracy of orders and protection of company interests for participants. Relationships and soft elements such as "trust" are significant factors in driving scale of participation.
- **Participation**: Scale of industry participation is a critical component of success. The more firms engaged in the initiative, the better the chances of achieving meaningful benefits and returns. This seems especially true of product standardization initiatives.
- **Objectivity**: Third parties have a significant role in promoting objective value creation across the supply chain in every example. While major industry players may participate in startup and initial investments, ultimate execution typically rests with a 3rd party (e.g., Dow and BASF vs. Elemica and OAGi).

There are also cautionary elements to this multi industry study. For example, there is the persistent risk of margin erosion, particularly in fragmented industries. Supply chain savings and cost reductions can escalate price cutting behavior thus resulting in value evaporating downstream. Pure plays in trading hubs and vertical markets, therefore, require some caution in execution.

The informational efficiencies gained by eCommerce activities can also give rise to new categories of players. Industry evolution is an ongoing process, however, eCommerce can accelerate change. Existing players need to keep up with the pace, or risk the potential of being left behind, as the example of Wal-Mart and other mass merchants in the grocery industry shows.

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APPENDIX: TEX-SPIN Initiative Details

Below we detail some of the major components of the TEX-SPIN initiative.

Moda-ML

Moda-ML's objective is to facilitate the inter-exchange of technical and managerial information of the textile/clothing supply chain, aiming at setting up a direct peer-to-peer approach without third party services, based on free SW module (MSH) compliant with ebXML transport specifications. It streamlined the fabric supplying process, defined the XML document classes described with XML schema, user guides, dictionary of terms and demonstrated software tools for sending, receiving, monitoring and validating the data exchanged (Mike Roberts, 2004; Sabbata, 2003).

1. Fabric supplying process
   With the focus on upstream integration between fabrics and clothing, Moda-ML standardized the e-order process from supplier selecting to fabric dispatch, described in Figure A-1.

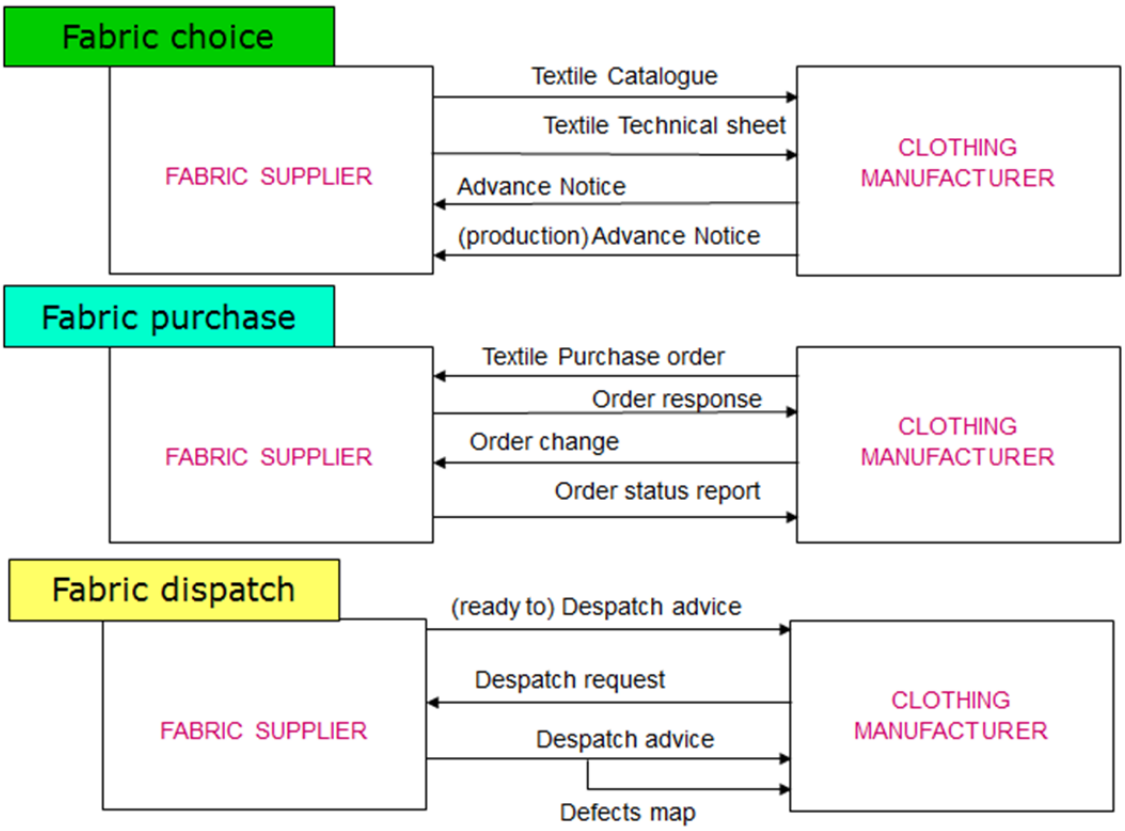

Figure A-1 - Fabric supplying process

Source: **(Sabbata, 2003)**

2. XML documents class
   A group of document classes that support the order-to-cash cycle have released by Moda-ML, activities covered include: fabric selection, fabric purchase, fabric shipping and fabric manufacturing. List of the document classes are shown in Table A-1.

Table A-1- List of standardized documents by Moda-ML

Source: **(Sabbata, 2003)**

Textile Catalogue	The (price) list of products offered for sale	Textile→Clothing
Fabric Technical Sheet	The technical characteristics and properties of the fabric article	Textile→Clothing
Textile Advance Notice	The anticipation of articles included in the Clothing Manufacturer's collection and of foreseen volumes of production that clothing manufacturers will request (no details on colours and variants)	Textile←Clothing
Textile purchase order	The order placed by the Clothing Manufacturer	Textile←Clothing
Textile Order response	The response provided by the Fabric Supplier	Textile→Clothing
Textile Order change	The order change initiated by the Clothing Manufacturer	Textile←Clothing
Textile Order status report	The status of the fabric order reported by the Supplier	Textile→Clothing
Textile Dispatch request	The request/scheduling of the dispatch of parcels made by the Clothing Manufacturer	Textile←Clothing
Textile Dispatch advice	The anticipation of the dispatch of the parcels by the Supplier	Textile→Clothing
Textile Quality Report	The report of the defaults and other non-conformities of the goods, as provided by the Supplier or by an independent Quality Controller	Textile→Clothing
Invoice	Invoice for the supplied material	Textile→Clothing
Textile darn order	The specifications of the darning operation required for each piece; includes allowed worktime, position and type of faults; it could contain or refer to a despatch advice	Textile → Darning
Textile darn return	The returning information about the darning operations; include the worktime spent, the position and type of faults and the associated information about the position, the initial status, the worktime and the final status	Textile ← Darning

3. Message Service Handler
   Message Service Handler (MSH) is the main message switching system that serves as an essential media to support the peer-to-peer approach. It validates Moda-ML documents, sends and receives them over the Internet using SMTP as its transport protocol (Gessa, Vitali, Cucchiara, Imolesi, & Mainetti, 2003). Figure A-2 illustrates the role how MSH helps connect companies during the transaction process.

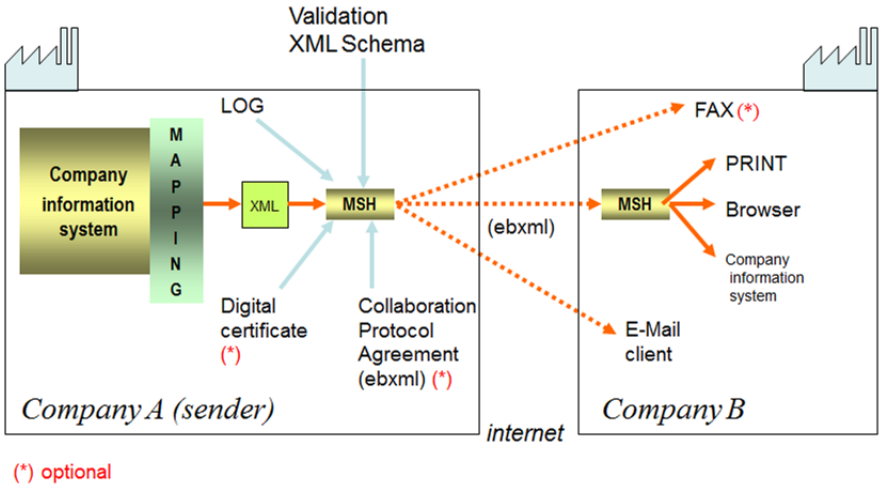

Figure A-2 - Message Service Handler
Source: (Sabbata, 2003)

The MSH also handles security issues encountered in online transactions. Signing algorithms (RSA) and certificate encoding satisfy the European laws, and signatures are compliant with XML signature standard. Different security levels that can address different companies' security and flexibility needs would be supported by Moda-ML as well. Transaction process with security check is shown in Figure A-3(Sabbata, 2003).

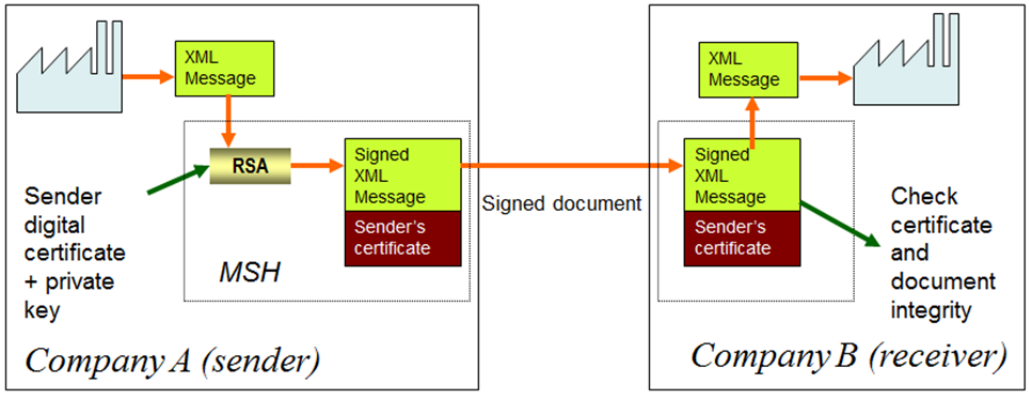

Figure A-3 - Security Algorithm
Source: **(Sabbata, 2003)**

eTeXML

eTeXML is a Web Service application to receive and send XML documents and convert them to EDIFACT messages, with the initiative to set up a EDI tools based on XML to allow the manufacturers and retailers to implement a reactive delivery strategy. Main results of eTeXML include a dictionary of descriptive information or technical specifications for the garment articles (DICALIS), a set of XML messages for the downstream part of the textile/clothing/distribution supply chain, and a demonstrative software component to illustrate practically how the XML based information exchange is carried out (Mike Roberts, 2004).

1. XML documents class
   The same as Moda-ML, eTeXML also developed a list of XML message templates for the downstream players in the textile/clothing sector. List of these documents are shown in Table A-2.

Table A-2 - List of standardized documents by eTeXML
Source: (Sabbata, 2003)

Product Catalogue	The product catalogue (characterisation of the product)	Clothing →Retail
Pricelist	The (price) list of products offered for sale	Clothing →Retail
Purchase order	The order placed TO the Clothing Manufacturer	Clothing←Retail
Dispatch advice	The anticipation of the dispatch by the Supplier	Clothing →Retail
Invoice	The invoice	Clothing →Retail
Sales report	Report of sales to the supplier	Clothing←Retail

2. Web EDI Architecture
   ETeXML acts as a web application and services to receive and send XML based documents between manufacturing company and retailers. Details of the EDI architecture are shown in Figure A-4.

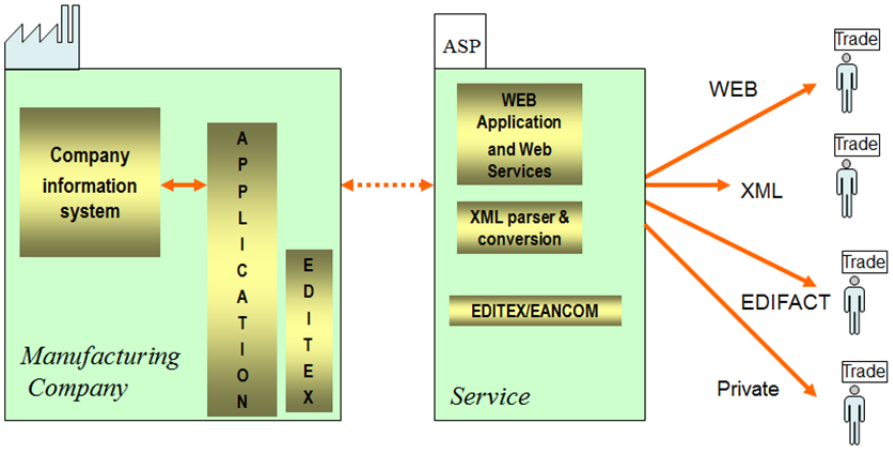

Figure A-4- eTeXML Web EDI Architecture

Source: **(Sabbata, 2003)**

3. Product Classification Code

   The product classification code, also known as Thesaurus Code, is a significant component of DICALIS and represents an important contribution to TEX-SPIN. It is a regional standard for product description with focus on the domain of product catalogues in the garments sector. The objective of the Thesaurus code was to set a classification scheme to enable retailers and manufactures to detect fashion trends and to allow the conversion of consumers' sales data into fashion trend report (Gessa, Vitali, Cucchiara, Imolesi, & Mainetti, 2003).

   A full version of Thesaurus code describes a four level taxonomy: product target, model, model description and additional information. The "product target" has four attributes: user's type (e.g. man, woman, boy, girl, baby), user's morphology (e.g. large sizes, basic sizes, and small sizes), use of product (e.g. sport wear, work wear) and style of product (e.g. fashion, basic). The "model" has two attributes: group of product (e.g. shirt) and product type (e.g. city shirt with long sleeves). The "model description" describes the model via elements such as components, fabric, color or pattern. The "additional information" could be sale information like quantity, size and price (Mike Roberts, 2004).