Implementation of Electronic Data Interchange Technologies by Suppliers as solutions to enhance Traceability in upstream Supply Chain

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3) Dr. Jean Escande, Director of Master QSE

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For confidential reason, the identity of the company in this Master Thesis is not revealed. It is referred to as “Enterprise E”.

“Center C” is the alias name of one of the company’s technology centers that has welcomed the student during her internship.

Acknowledgement

This Mémoire d'Intelligence Méthodologique (MIM) represents not only my work during the internship; it is the final milestone of my two years of studies at UTC (University of Technology of Compiegne) and specifically within the Master of Quality program. My experience at UTC has been no less than wonderful. I have been given trust, confidence, and opportunity to pursue higher by my teachers regardless the language and cultural challenges I had to deal with, undertaking my first academic experience in France. This MIM is the result of first experiences I have obtained at UTC and Enterprise E working with remarkable individuals whom I would like to acknowledge.

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Finally, I would like to thank my family, especially my parents, for the continuous support upon their three daughters, to pursue higher studies, to be accomplished professionals, and to make this world a better place.

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Glossary

Barcode

a machine-readable code in the form of numbers and a pattern of parallel lines of varying widths, printed on a commodity and used especially for stock control.

Barcode Label

Material with a adhesive backing that has a printed bar code on the face.

Business Intelligence

Business intelligence (BI) is a set of theories, methodologies, architectures, and technologies that transform raw data into meaningful and useful information for business purposes. BI can handle enormous amounts of unstructured data to help identify, develop and otherwise create new strategic business opportunities.

EDI

Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.

ERP

ERP is an industry acronym for Enterprise Resource Planning. Broadly speaking, ERP refers to automation and integration of a company's core business to help them focus on effectiveness & simplified success.

Internal Supply Chain

Internal supply chain refers to the chain of activities within a company that concludes with providing a product to the customer.

Invoice

A list of goods sent or services provided, with a statement of the sum due for these; a bill.

Order Acknowledgment

An Order Acknowledgment is a confirmation to buyer that supplier has received and processed buyer’s order.

Procurement Department

The Procurement Department is the office responsible for the acquisition of supplies, services, and construction in support of the Authority's business.

Purchase Order

A purchase order (PO) is a commercial document and first official offer issued by a buyer to a seller, indicating types, quantities, and agreed prices for products or services.

Introduction

This MIM is a description and analysis of my five months internship carried out as a requirement to validate the competence obtained throughout coursework of the Master in Quality Management, UTC.

The motivation of continuing my higher studies in the domain of Quality Management came from one idea, inspired with the success story of Toyota. In today's economy, I believe that the toughest competition is no longer business versus business, but rather quality versus quality. Those who are the most effective and the most efficient in their business practices are those who tops the competition. That is why the philosophy of continuous improvement across functional boundaries should be adopted as a culture in the company who wants to grow sustainably. Driven by curiosity and challenge, my planned role is to become a quality improvement agent in the environment in which I will work at.

Having a background in Industrial Engineering and interested to the Service Systems and Supply Chain, I decided to develop myself by interning in a Supply Chain Department. Another criteria to choose to intern at Enterprise E is that this company enables an international and cross-cultural exposure, thanks to the opportunity of working with internal collaborators across the continents and with external global suppliers. My goal in this first experience working in an international context was to gain fundamental competences to begin my future career in Quality and/or Supply Chain.

The company's activity sector in brief

Enterprise E is the world leader *in its field*, with expertise in technology and research of the upstream large energy industries. Enterprise E was known to contribute disruptive innovation in the energy industry during the era when it was created, it then continued to expand its operations and acquisitions over the

years, and remains the worldwide leader as of today. With revenue EUR 33 billion on 2013, Enterprise E is serving areas worldwide.

As the price of energy goes up, budgets are swelling, so energy companies will find ways to keep investing a reasonable unit cost while scaling up productions. They will turn to companies like Enterprise E which is set for a gusher of profits.

For confidential reason, figures on activity sector will not be discussed in this MIM.

For this internship, I was welcomed in one of Enterprise E's technology centers in Europe, call it center C. I was assigned to implement new business systems within the supply chain department, and suppliers with who center C is expected to have transactions of EUR 72 million by the 2014 Year End.

Entreprise E has numerous relations with suppliers located throughout the world. Figure 1 illustrates the global distribution map of the center C's top 115 suppliers.

Figure 1. Global supplier distribution map of Enterprise E's technology center C [1]

The supply chain department

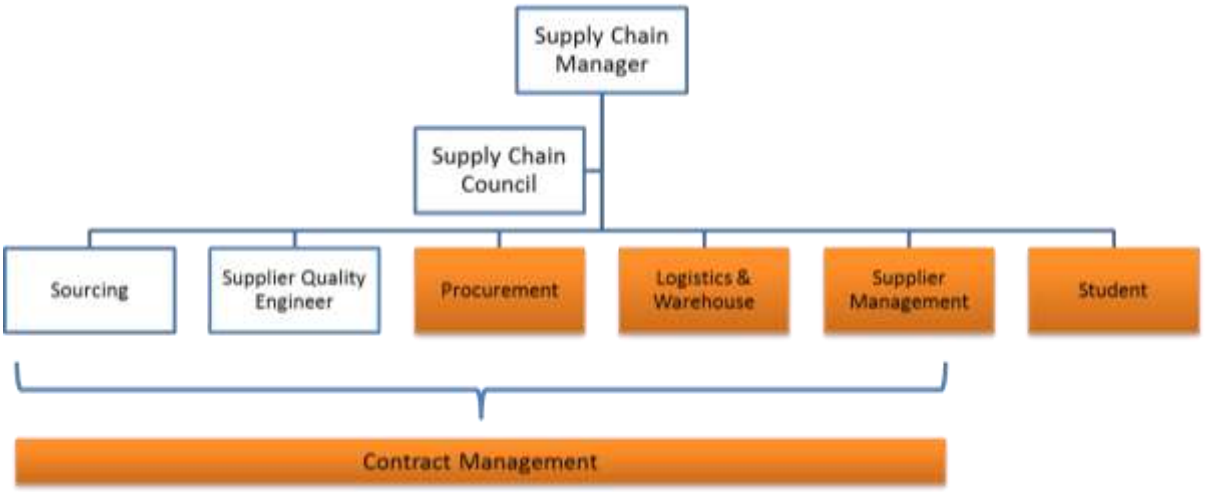

Figure 2. The supply chain organizational structure [1]

In this internship, I worked mainly with four supply chain collaborators as highlighted above:

1) Procurement Team
2) Warehouse Team
3) Supplier Managers
4) Contract (Legal) Department

Learning goals

At the beginning of the internship I formulated several learning goals, which I wanted to achieve:

- to understand the role of Supply Chain in manufacturing and service industries;
- to observe what is like to work in a professional environment;
- to see if this kind of work is what I really want for my future career;
- to validate my skills and knowledge obtained during my studies;
- to see what skills and knowledge I need to develop to work in a professional environment;
- to learn how to organize several parallel projects given a limited time
- to learn how to improve processes using robust methodologies;

- to get on-the-job experience in an environment unknown for me;
- to learn how to adapt working in another country, with co-workers from different cultures;
- to enhance my professional communication skills;
- to build a network.

This MIM contains problems discussed in literature studies, not to mention my activities that have contributed to achieve a number of my stated goals. In the following chapter a general description of the company's upstream Supply Chain topology, and how traceability is vital, is given. Then I will illustrate how technology can allow company to have a better traceability. Later a reflection on my methodology, the results and the learning goals achieved during the internship are described. Finally I will conclude on the internship experience according to my learning goals.

Chapter 1
The Importance of traceability in upstream supply chain

Chapter 1. The importance of traceability in upstream supply chain

1.1. Context

It has become the key objectives for a company's upstream supply chain management to provide the right product, at the right time, the right quality, quantity, and the right price, to support the internal operations of the company[2]. Upstream activities can oftentimes hold great importance for companies, because many traits valued by end users might be influenced or directly defined by partners maintaining upstream activities. Likewise, many strategic initiatives taken by various companies like e.g. quality improvement, timely delivery and innovation are often directly linked to the performance of upstream activities, and must be handled proactively by companies reliant on the performance of others.

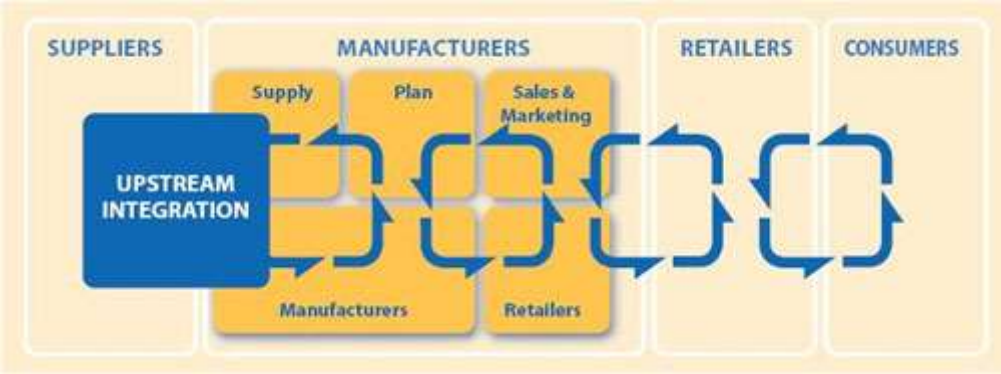

Figure 3. Upstream supply chain deals directly with suppliers[3]

For this pivotal role, supply chain department is therefore responsible to coordinate well with suppliers. Companies might actively engage suppliers in R&D projects to secure the capabilities of suppliers, or develop other competencies of suppliers like e.g. speedy delivery, high quality and high reliability. The key is to identify what is valued by the end consumer, and thereafter secure or develop the needed competencies required of suppliers. Likewise, companies may engage in IT sharing with upstream partners that will

potentially secure a more streamlined reordering, capacity planning and forecasting, so that suppliers and logistic partners are able to meet specific requirements related to production capacity, time of deliveries etc.[4]

Figure 4. Coordination between supplier and buyer[1]

(Adapted from APICS, version 2.2, 2011 Ed. Pg. 1-3, with modifications)

Figure 4 presents a relatively straightforward, horizontal and linear view of upstream supply chain, which is often not the case. The flows of goods, information, knowledge, and funds across supply chain are oftentimes uncoordinated and fragmented. In the real process flow, there is always a space for improvements on the interfaces between each entity.

1.2. Benefits of traceability in upstream supply chain operations

1.2.1. Process traceability

When volume of transaction flows with suppliers gets higher, traceability is needed to improve the communication efficiency, and to avoid getting lost in the middle of the complex processes. Today's traditional supplier-buyer communication use emails, fax, and telephone to get the business done. That is, to imagine how many emails diffused by an X number of procurement team to a Y number of suppliers.

This situation can be improved by providing a more practical tool to trace and monitor this communication that can serve as a strategic tool for managers. In order to reduce costs and improve efficiency, many corporate giants are now

demanding that their suppliers convert their transaction operations into EDI (electronic data interchange) systems. This subject will be further discussed later in the next chapter.

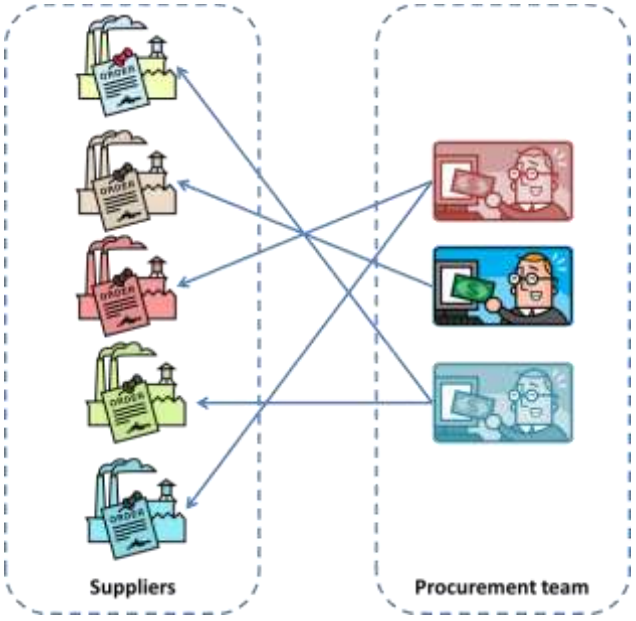

Figure 5. Supplier-buyer communication flow during purchases[1]

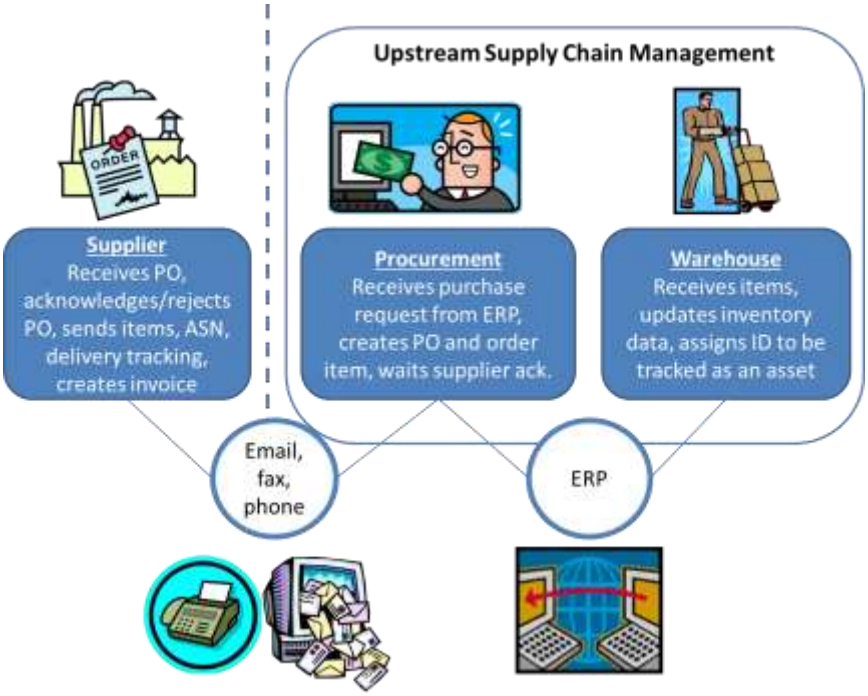

Figure 6. Upstream supply chain activity during a purchase activity[1]

1.2.1. Product traceability

Traceability is also needed in the communication between warehouse and procurement team, especially during reception of items. When supplier items arrive with traceability labels (e.g. barcode), warehouse team can scan the labels to trace and identify the corresponding purchase orders. Based on this information scanned, the data are then automatically updated in the company's ERP (*enterprise resource planning*) such as Oracle, SAP, MfgPro, telling that items have been received. The procurement team can then process the payment.

In a more global context, *upstream* supply chain operations can be very critical. Given one example: Enterprise E is targeting to improve its asset management, that means operating and maintaining its tangible assets cost-effectively. Although this goal concerns mostly the ready-to-use assets downstream supply chain, relevant information associated with the asset has to be provided from the very upstream, so in case of any repairs, information can be traced backward.

Center C either sells parts to the customer that come directly from the suppliers, or uses parts from the suppliers to manufacture internally a final product, which is then sold to the field. In a specific case of Enterprise E, when an accident caused by field equipment happens, one can trace the root cause of the defect. It can be caused either by bad manufacturing, or by bad parts coming originally from suppliers upstream. In the latter case, it is important for upstream supply chain activity to implement traceability labels. Records of all purchased products shall be maintained and kept, so if a problem arise, the company can trace back to where they started.

1.3. Problem scope

This internship addressed the traceability issues in *upstream* Supply Chain. Process automation has been discussed internally by Enterprise E to become the solution to traceability issues. My assignment is to begin implementing this solution and then increase users' adoption. The directly concerned parties are the

suppliers and the internal supply chain department (in this internship mission, particularly procurement team and warehouse team).

This internship's focus is on the socio-technical aspect of the process automation, and not on the system programming which is under the responsibility of IT department and software provider.

The scope of this MIM does not, however, deeply discuss about ROI (return of investment), and the direct impact of this project to company's profitability, all which have been conducted internally by Enterprise E prior to this implementation phase.

1.4. Objectives

The objective of traceability in supply chain management is to organize all activities related to the flow of products and information process from the beginning of the supplier's cycle to the end-user[5]. The challenge is to manage this process in such a way as to establish collaborative alliances with strategic suppliers[6] and to explore alternatives in which the management of suppliers can be used to gain a competitive advantage in the industry[7].

However, in this internship, the objective is broken down into more precise action items (see Figure 7). A selection of add-on EDI (electronic data interchange) technologies was proposed, those are:

1) **Implementation of Barcode labels by suppliers, for a traceable inventory reception in warehouse**
2) **Implementation of Supplier Web Portal with suppliers, for a traceable purchasing activity in procurement**

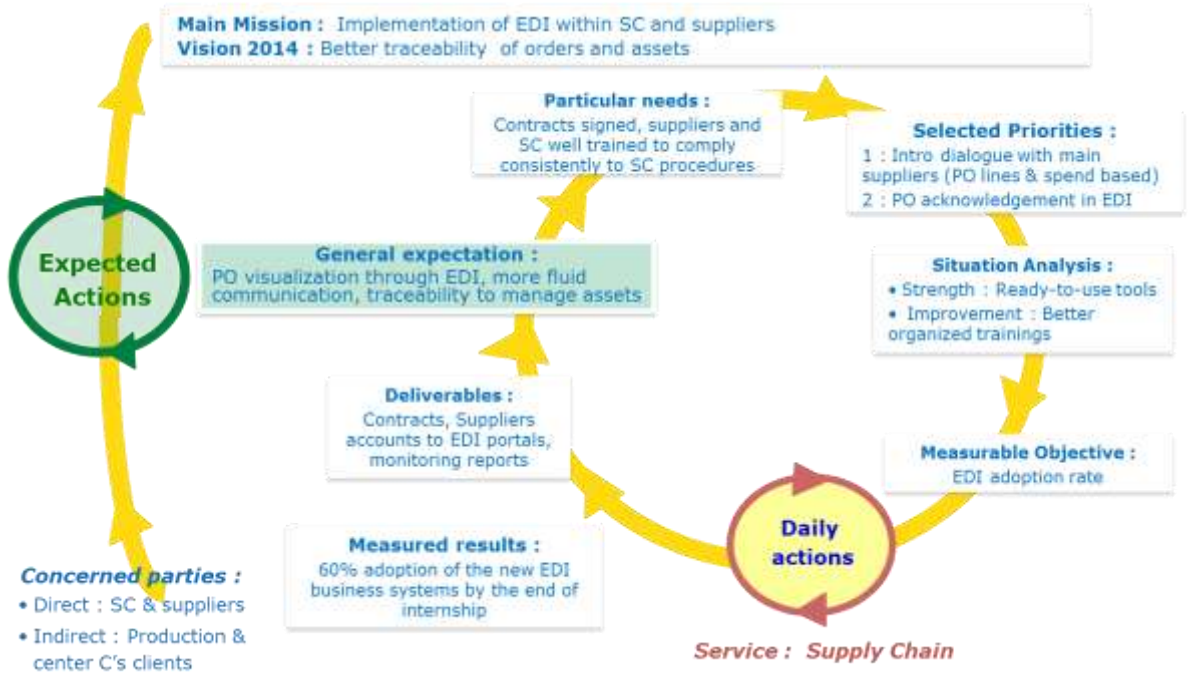

Figure 7. Strategic planning to achieve the internship objective[1]

1.5. The principal norms and regulatory requirements

1.5.1. The ISO standard on traceability

This MIM takes a closer look to the complex set of traceability issues within *upstream Supply Chain* of Enterprise E, in which the company attempts to create value for its stakeholders in the continuous improvement framework. The concept of traceability was based on ISO 9001:2008 and ISO 8402, and the company aims to maintain the compliance with this standard to further manage their processes better.

What is traceability?

"the ability to trace the history, application or location of what it is under consideration"

ISO 8402:1994

ISO 9001:2008

This paper also focalizes on the concept of process as today mirrored in the prerequisites of normative quality, as the new ISO 9001: 2008 standard encourages a process approach to quality management. *Business processes are valuable corporate assets since they directly support corporate business strategies. Business processes, therefore, need to be managed and optimized just as any other business assets*[8].

To explicit, two selected traceability issues are covered within this internship:

1) Physical flow (later referred to as product traceability), and
2) Information flow (later referred to as process traceability)

As for **product traceability**, let us recall the following chapter of ISO 9001: 2008[9]:

> 7. Product Realization
>
> 7.5 Production and Service Provision
>
> 7.5.3 Identification and Traceability
>
> *"Where appropriate, the organization shall identify the product by suitable means throughout product realization.*
>
> *The organization shall identify the product status with respect to monitoring and measurement requirements throughout product realization.*
>
> *Where traceability is a requirement, the organization shall control the unique identification of the product and maintain records (see 4.2.4).*
>
> *NOTE In some industry sectors, configuration management is a means by which identification and traceability are maintained."*

There are three different requirements specified in this chapter[10]:

- Product identification - means knowing the identity of (yours or customer supplied) product from - incoming receipt of materials; raw material storage; use in production; work in progress; finished product storage; and delivery of product to the customer. Product identification can be controlled using physical and electronic methods.

- Product status - means knowing the quality status (good or bad) of materials and product through each of the above stages. Product status can be controlled using physical and electronic methods.

- Unique Product Identification - is not a mandatory requirement under ISO 9001, unless contractually required by customers or regulatory bodies. In certain industry sectors such as the automotive or aerospace or pharmaceutical industry, unique product identification is mandatory for safety, regulatory and risk management reasons. This usually involves keeping detailed records of product manufacturer - material; equipment; personnel; processes; production; inspection and test details, etc., for individual products or production batches. These records help to trouble-shoot product and process problems; resolve customer complaints; and enables continual improvement of product and process. In many instances, it also reduces cost, risk and use of resources by narrowing the problem down to a specific cause or instance. Depending on the product, the OEM may specify the degree of unique identification and traceability required. Examples of product identification and test status include physical tags, bar code labels linked to computer records; MRP systems tracking specific production runs/lots; automated production transfer processes, etc. Performance indicators (to measure the effectiveness of processes that control identification and traceability) may include - reduction in identification errors and omissions; product quality status errors and omissions; and traceability errors and omissions.

As for **process traceability**, there is one crucial requirement regarding information flow, particularly in purchasing activity. Traceability and its records must be maintained. Let us recall the following chapter of ISO 9001:2008[9]:

> 7.4.2 Purchasing Process
>
> *The information of a purchased product will define the product and its characteristics; that is, the specifications and requirements.*
>
> *The information shall refer to the determination of processes, procedures, and the use of tools equipment, and procedures.*

ISO Standard clearly requires maintaining records, which target is to provide objective evidence that the processes were conducted effectively. There is a freedom to select which communication channel to send orders, be it e-mail, printed orders, or by the installation of an EDI (electronic data interchange). There is no requirement to documents the method of transferring an order to the supplier, but there is a requirement to prove it with records.

1.5.2. The legal requirements of automated business process

The selected method of traceability and documentation discussed in this MIM is the use of EDI (electronic data interchange) in business transactions. In general, most EDI communications between businesses utilize existing telecommunications facilities. Although direct point-to-point transmission of EDI communications between trading partners does occur, the more prevalent practice (both domestically and internationally) is communication through third-party networks or service providers. These providers are able to achieve economies of scale that make their service an attractive alternative to internal capital investment in EDI users in network facilities, even for those who have the economic capability to make such an investment[11].

The biggest issue in EDI implementation is that all transactions during procurement/purchasing are paperless, because information is recorded and modified throughout the machine (computer and web) and people have been questioning if paperless contracts are valid enough to be recognized[12]. To solve this problem, suppliers and buyers usually establish a *Purchase Terms & Conditions* that specifies EDI in the beginning, and a *Computer Based Information Agreement*, signed prior to implementation of EDI (creation of accounts). EDI users usually also enter into a service agreement/legal contract with a third party provider. Pursuant to the agreement, the provider essentially functions as an electronic mail processing system, and may either 1) maintain electronic "mailboxes" for trading partners into which EDI communications may be placed, or 2) interconnect with other providers in order to facilitate communication between their respective customers[11].

1.6. The prospective ethical and societal dimensions

This will not be described deeply in this MIM but there are two potential things to highlight in further studies:

1) Product traceability: In a Corporate Social Responsibility context, traceability allows companies to account for the ethical, social, and environmental impact of its products along their supply chains.

2) Process traceability: Process automation has been seen as a competitive strategy in creating traceability, it makes companies' processes become lean. The main benefit of process automation is that companies can improve the efficiency and productivity of its service. On the other hand, any new IT system can also be seen as a cost-cutting tool by employees that will lead to dehumanization and reduced job opportunities. The approach to implement the new system has to take into account this aspect.

Consideration of the ethics of technology implementation in business transactions has also mainly focused on areas relating to the abuse of information collected. In this context, the main issues include security and privacy of information about companies and ownership of information that can be traced by fraudulent activities. Clear contracts have to be set between the concerned parties to guarantee the security of information exchanged in the web portals. A risk analysis regarding to data security will be assessed later in the next chapter.

Chapter 2

Implementation of automated manual data entry in purchasing and reception

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2.1. Top benefits of automating manual data entry in purchasing and reception

EDI has helped simplify and improve commerce between trading partners for years and its benefits continue as it improves more business processes such as electronic procurement, automated receiving, electronic invoicing, and electronic payments. EDI can reduce the cost of personnel and office space, improve data quality, speed up business cycles, improve efficiency, and provide strategic business benefits[13].

To deeply elaborate the benefits of process automation through EDI (electronic data interchange) briefly described in the previous chapter, we will describe the benefits into five categories as shown in the table below[14]:

Table 1. Five benefit categories of EDI[14]

Reason #1: Monetary savings	Automated solutions for inventory and procurement deliver big savings over manual systems — from reduced administrative costs to shortened procurement and fulfillment cycles. An automated bid system also drives down the cost of supplies by allowing procurement staff to increase the number of potential vendors and identify preferred suppliers. In large properties, where purchasing responsibilities are spread over several departments or several locations, an automated inventory and procurement solution can maximize buying power by consolidating orders, which typically lowers the cost per transaction and results in deeper volume discounts.
Reason #2: Time savings	An automated inventory and procurement solution saves time by streamlining purchasing and inventory control. Tasks that once took hours or even days can be performed with a few clicks of a mouse. Staff no longer wastes time matching receipts with deliveries, figuring out overly complex invoices and keying in redundant information. Properties also will see a reduction in the administrative tasks involved with vendor management, such as creating contracts and soliciting bids. Likewise,

	purchasing managers will spend less time overseeing administrative details and more time analyzing spend patterns and negotiating favorable terms with suppliers.
Reason #3: Increased accuracy	An automated inventory and procurement solution increases accuracy. Because staff is no longer required to re-enter data from paper documents, clerical errors and ordering mistakes are reduced. Moreover, automated solutions link usage to demand, enabling properties to maintain up-to-the-minute inventory counts, obtain accurate operating costs, track the cost of sales and identify the best and worst performing cost centers.
Reason #4: Enhanced negotiations	In order to effectively negotiate with suppliers, managers must understand what they are purchasing, in what volumes and at what price. An automated inventory and procurement solution can provide this information, giving procurement professionals greater leverage to negotiate price breaks, volume discounts and favorable payment terms. Armed with details about spending patterns, purchasing staff is able to view the 'big picture' and make fact-based decisions that result in cost savings and more accurate inventory counts.
Reason #5: Increased compliance	Properties are finding it necessary to standardize procurement processes and make sure employees at all levels are using pre-negotiated pricing. For procurement managers, an automated solution ensures that a single standard for buying a certain kind of product is enforced across the board. An automated inventory and procurement system also helps curtail 'maverick' buying, or the practice of purchasing items outside of the preferred system, through approved vendor lists, pre-sourced catalogs and standard ordering and approval processes. Centralized tracking allows purchasing managers to monitor off-contract buying and ensures compliance with established contracts. In an industry where margins are tight and multiple departments often requisition items several times a day, it makes sense to automate inventory and procurement. An automated system not only optimizes existing resources and prevents unnecessary costs, but also positions the property for success, in the short-term and the future.

Sometimes, in order to make a decision to embark on a new EDI program or expand their current EDI projects, companies seek quantitative data to educate their executive teams and drive a more holistic understanding of the EDI processes and benefits for the greater organization[13]. They want hard facts that answer questions such as:

- How many days earlier can orders be shipped when EDI is used for the ordering process?
- What are the actual cost savings that companies realize when they use EDI Advance Ship Notices (ASNs)?
- What are the actual cost savings that companies realize when they use barcode labels or RFID tags?
- What are the top challenges that businesses face when EDI is not used as part of the ordering process?
- How do supplier companies really benefit when they comply with their customers' requests to exchange business documents via EDI?

82% of respondents in Supply Chain Insights' new study "EDI: Workhorse of the Value Chain" indicated that one of the major improvements resulting from their EDI programs was better or much better visibility of orders and shipments in the supply chain[14].

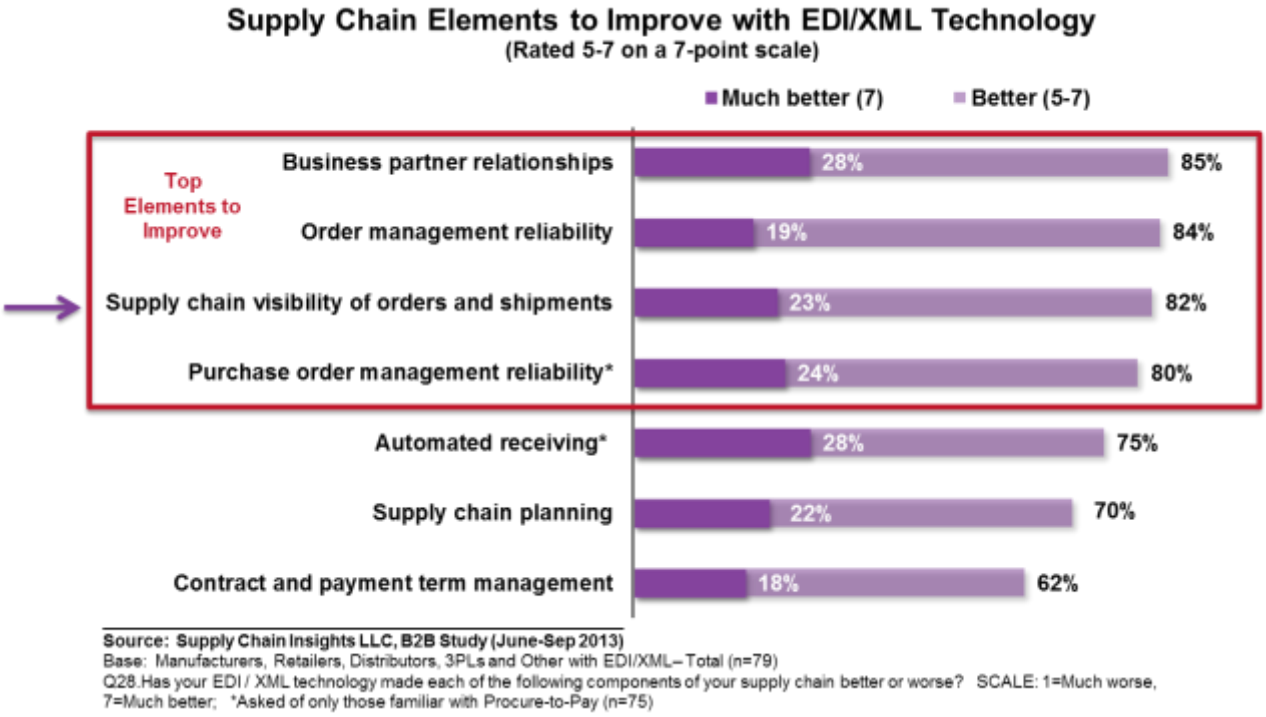

Figure 8. Supply Chain Elements to improve with EDI/XML technology[15]

It's easy to understand why the visibility benefit was one of the top four: 1) Business partner relationships, 2) Order management reliability, 3) Supply chain

visibility (traceability) of orders and shipment, 4) Purchase order management reliability. In today's fast-paced business environment, having real-time insight into transaction status is the key to enabling faster decision-making and improved responsiveness to changing customer and market demands. Businesses need to know answers to questions such as:

- "Was my order accepted?"
- "Which version of the order are you shipping against?"
- "Will the order ship on time?"
- "What is the status of my invoice?"

EDI transactions enable that vital level of real-time visibility and traceability into status of orders in the supply chain. For example, using EDI, a manufacturer in Houston, Texas can send a purchase order to its supplier in Malaysia, receive an electronic document that the item is out-of-stock, and immediately react by sending the purchase order to an alternative supplier in Dubai – all in just minutes. Armed with this information businesses can effectively manage bottlenecks, plan for delays, and proactively manage customer expectations. In short, they can resolve issues before they have a negative impact on business performance.

Here are just a few of the EDI documents that enable visibility into the supply chain:

- Purchase Order Acknowledgment: Confirmation to the buyer that the supplier will be filling the purchase order as requested.
- Advance Ship Notice: An electronic version of a printed packing slip that tells a buyer that goods have been shipped, how they have been packed and the estimated arrival time.
- Invoice: Request to the buyer to pay for the shipped goods.

In summary, EDI provides the foundational technology that, when combined with other collaborative commerce capabilities available today, enables dramatic strategic benefits.

2.2. The EDI collaborative tools

2.2.1. Tool #1: Supplier Web Portal for purchasing activities

To improve the process traceability in the upstream supply chain of Enterprise E, Supplier Web Portal was implemented. Procurement professionals are the lifeblood of the company to guarantee stable supply chains. It is the company's interface who deals with suppliers when placing orders and ensure the suppliers acknowledge the reception of orders and abide to the schedule agreed during order placement. To make fluid the communication in this interface, a contribution of IT is essential. Supplier Web Portal tool allows suppliers to receive and acknowledge orders in real-time, right when orders are set in the company's ERP. Supplier Web Portal tool also allows the supply chain manager to visualize the all transactions with suppliers on a purchase order line-by-line basis. The tool includes also a log of the specific transactions (order date, part technical reference and revisions, shipment initiated, goods received, etc.)[16].

Supplier Web Portal is Web portal to manage cycle from PO (purchase order) submission through goods receipt and payment.[1]

Supplier Web Portal provides full visibility and traceability of purchasing activities, allowing supplier responsiveness to be monitored, orders to be chased/quickly acknowledged and arrival dates maintained. The common unified paperless database can be used to track all open, closed, and canceled purchase orders, along with message exchange between suppliers and buyers, so nothing is invisible or hidden under buyer's email inbox.

Orders, once planned, are fed to the manufacturing group, placed to supplier, and tracked throughout the process all the way to delivery. Just a few years ago, this chain of processes required days of sequential telephone, fax, and computer queries. In addition, it was fraught with errors, added time, and information disconnects.

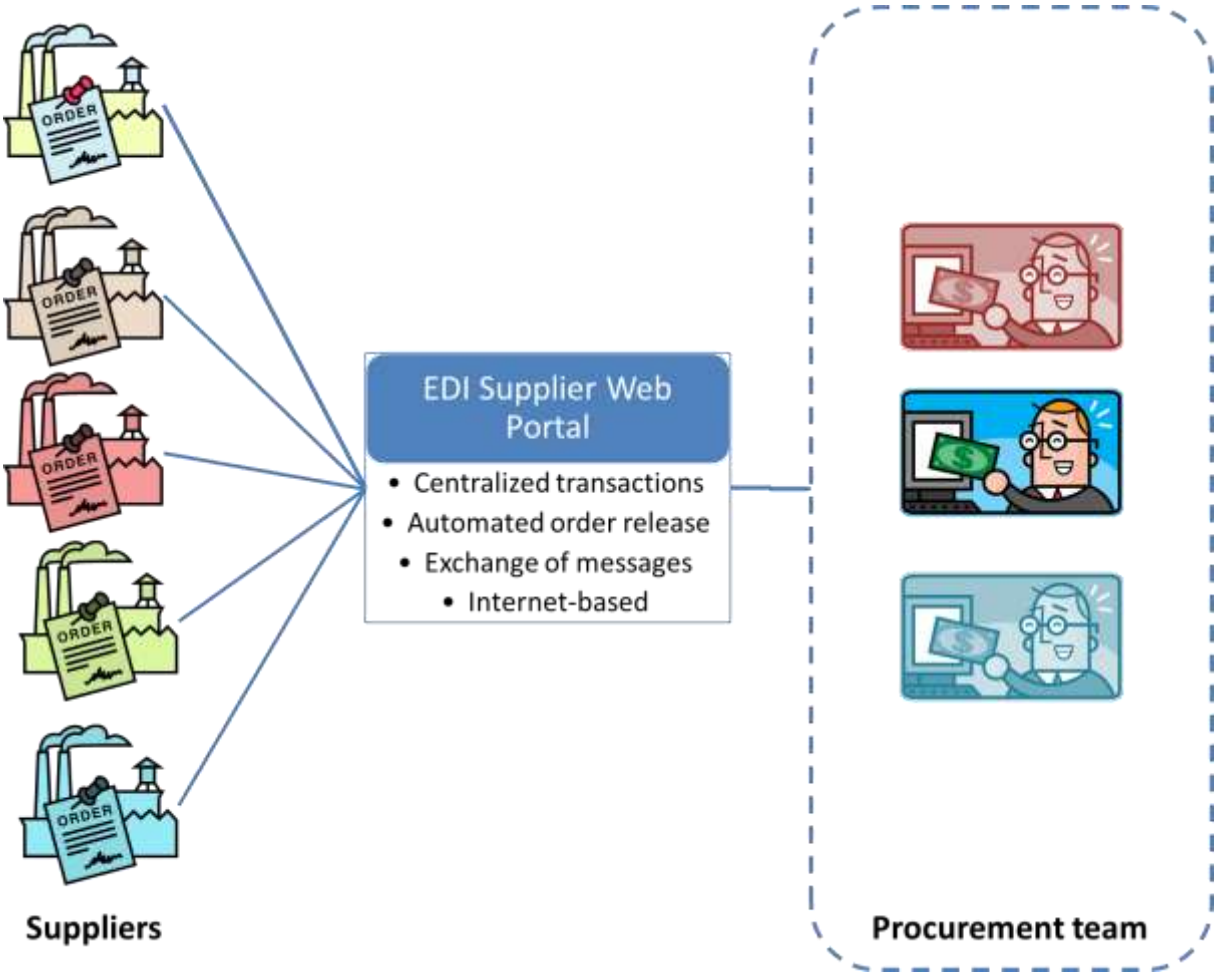

Figure 9. Improved purchasing activity - post implementation Supplier Web Portal[1]

Figure 10. Message flow diagram in Supplier Web Portal[1]

The real-time shared collaborative Supplier Web Portal tool delivers powerful advantages to buyers and suppliers. These results include fewer mistakes in orders, reduced lead times, and shortened cycle times[16].

With Supplier Web Portal, not only buyers can benefit, suppliers also can:

- Receive email alerts when there is new PO or PO revision
- View & acknowledge orders
- Self-service Engineering Bill of Materials & Drawings
- Alert buyer of incoming goods via Advanced Shipment Notices
- View status of goods receipts
- Check status of invoices and payments
- Collaborate with Procurement by exchanging messages (for example, to propose a new delivery date, quantity, price, etc).

On top of that, there are also intangible benefits for suppliers:

- Staying competitive – supplier's ability to respond to customers' needs as efficiently as the other rivals, and
- Moving towards an exception based end-to-end process within supplier's supply chain, concentrating human effort on areas that improve efficiency and customer service.

2.2.2. Tool #2: Barcode labels for warehouse activities

Supplier barcode labelling or automated identification has been known to help reduce human error in logistics. Furthermore, it helps not only the identification during reception, storage and picking in the warehouse, but also passing along the information all the way midstream (manufacture) and finally downstream to the end-user. Automated identification enable the visibility and traceability of products, regardless its supply chain complexity[17].

The human error that occurs during warehouse reception has a non-negligible cost. There are many calculations for the cost of a data entry error. The elements involved in an incorrect data entry include[18]:

- cost of recovering the item;
- labor cost of in-handling and checking the item on its return;
- cost of picking the replacement item;
- cost of re-packing;
- cost of re-delivery;
- cash flow with reference to non-payment of invoice;
- potential loss of sale for the product incorrectly dispatched;
- cost of re-training staff; and
- potential stock write-off if the returned product is outside an acceptable shelf life or has been damaged in transit.

To give another example of the use of barcode labels during picking, imagine a warehouse with 20 order pickers that pick 100 cases per hour (based on an eight-hour day, 253 days per annum). An accuracy rate of 99.5 percent incurs 20.240 errors per annum. An increase in accuracy to 99.8 percent reduces the errors to 8.906 errors. If each error costs a conservative $29, that amounts to annual saving of $475.000. *Note: this is just a general example to illustrate the situation, as I am not in charge of evaluating the cost aspects of this project for Enterprise E.*

To improve the traceability and accuracy for warehouse activities, Enterprise E provides a Barcode Web portal from which suppliers can print 2D or QR barcode labels for each product ordered. This Barcode Web portal is connected with the Enterprise E's ERP (enterprise resource planning) that will provide the information as follows:

- purchase order number, purchase order line,
- part number,
- supplier name and/or reference,
- quantity of product/serial number,
- batch/lot number,
- delivery date requested,
- date of production, and
- date of expiration, if applicable.

Every Item Part and/or its package shall be labeled with a Barcode Label before delivery to ensure traceability of the Item Part to its original Purchase Order or Work Order. The barcode label printed out of the Barcode Web Portal, a self-adhesive label, is to be applied to the top left corner of each package.

The item or package label must be generated via the Barcode Web Portal, and not from any other barcode generator, to be registered into the Enterprise E's Global Traceability system and assigned the Global Traceability key which is part of the barcode syntax. No software or software licensing fees for suppliers to access the Barcode Web Portal. Supplier needs only to click on each order number listed on the Barcode Web Portal that corresponds to a product ordered, and then print a barcode label out of it, to finally stick it to the product accordingly. Some requirements are needed before being able to implement barcode labels: quality of label paper, type of printer compatible to print 2D barcode, and a person assigned to access the Web Portal.

Prior to implementation, the supplier shall submit the name and email of the contact person(s) who should be printing barcodes to goods before expeditions. This contact person will then be created an account and trained to use the Barcode Web Portal. It is the responsibility of the supplier to provide barcode labels that meet all of the specifications of Enterprise E. The supplier shall be responsible for verifying the accuracy of the label and ensuring that the data is current and correct. Enterprise E won't drop suppliers simply because they don't bar code. However, over time, as bar coding becomes more important in Enterprise E's goods receptions and operations, it is possible that, everything else being equal, bar code labeling could be the determining factor in selecting one supplier over another.

With Barcode Web Portal, not only buyer can benefit, suppliers also can:

- Track good receipts,
- Adding value into service to customers.

2.3. Methodology

As important as finding the right program to automate the system, implementation of the program itself is very important. To determine the "best practices" for implementing new automated business system, there are three most widely discussed ERP and/or EDI implementation strategies that I refer to:

Table 2. EDI implementation strategies[20]

Method	Strength	Weakness
1) Big bang Description: Implementation happens in a single instance. All users move to the new system on a given date.	• Short implementation time • Difficulty and pain are condensed • Costs are much lower than a long, drawn out implementation • Employees only need to be trained on the new system, not for the changeover period • Implementation happens on a single date and everyone knows the date	• Difficulties are more pronounced, risk is high • Details may be overlooked in the rush to change • Employees have less time to learn the new system • Full end-to-end system testing is tough to carry our prior to implementation • Fall-back scenarios are more difficult than originally perceived • A failure in one part of the system could affect others • There is a catch-up period (users are struggling with the new system and organizational performance temporarily declines as a result).[20]
2) Phased rollout Description: Changeover occurs in phases over an extended period of time. Users move onto new system in a series of small steps.	• Companies gain knowledge and experience during the initial implementation phase that can be applied to subsequent phases • With conversion occurring in parts, time is available for adjustments • There is no catch-up period, employees learn as they go • More time for users to adapt to the new system • Technical staff can focus on one part of the system or a select group of users at one time • Project members may develop unique	• Not as focused and urgent as big bang • Involves continuous change over an extended period of time • Several adjustments are needed • Duration of the project is much longer than big bang • Temporary bridges must be created between legacy system and new system

	implementation skills that they can be positioned for in later rollouts	
3) Parallel adoption Description: Both the legacy and new ERP system run at the same time. Users learn the new system while working on the old.	• The least risky implementation process • Users can learn the new system while performing regular work activities on the old system. • User adaptation is easier than big bang • The pace of the changeover is faster than phased adoption	• Cost perceived is the biggest trade-off • Having users enter data in both systems is inefficient

I realized while one strategy may work for a majority of companies, it may not be the best strategy for another organization. In some cases, a phased deployment might be more appropriate than a parallel deployment, in some other cases, it might be the opposite. Depending on the goals, each company might prefer a combination of strategies. There is no one-size-fits-all.

Before starting the implementation, a little telephone survey was hosted upon other technology centers of Enterprise E in Europe, to get the idea what might be the best alternative strategy for Enterprise E's center C. Without giving a regard on the size of the technology center and the number of its suppliers, the survey uncovered that it took them *two years* in average to implement the new automated systems within the supply chain department and 80% of all suppliers. The strategy chosen by the centers having already implemented the new automated systems was a combination of phased rollout and parallel adoption, customized to each new user. The consideration behind it is to avoid disturbing production and other business activities happening during new business systems implementation.

Based on this valuable feedback, considering the very limited time of my internship (five months), and the ambitious 2014 year-end target, a fast-paced work has to be done. A timeline was then created (see Appendix) in order to help plan the actions. A combination of phased rollout and parallel adoption was then selected, to avoid disrupting the purchasing activity with shock effect of Big bang.

2.4. Risk assessment to EDI implementation

Before implementing the new business systems, I analyzed the risks existing associated to the EDI business systems implementation. Based on the risk assessment, I concluded that there are two types of risks:

1) Technical Risks, including in-depth knowledge of EDI, B2B, and Internet Security (this needs to be further assessed by technical experts), and

2) Business Risks, including process improvement, process documentation, project leadership, and culture analysis and management.

Table 3. Risk assessment to EDI implementation[1]

Risk	Actions	Who follows up?
Personnel security factors	Background checks • User IDs/passwords • Trace of individual accounts and time stamping	• EDI IT Help • Project champion
Contractual security factors	Customer contracts/requirements • Trading partner agreements (Purchase Terms & Conditions) • Confidentiality agreements (Computer Based Information Agreement) • Employee contracts and code of conduct • Contractor contracts and code of conduct • Third party—service bureau—contracts	• Supplier leader • Project champion • Legal department • Third party EDI provider
Data/Transaction security factors	• Encryption - switch this on to ensure that the in-flight data cannot be read • Digital certificates to be able to access technical documents associated to each purchase order	• Project champion
System security factors	• Passwords/PINs • Administrative levels of access	• Project champion
Network security factors	• Web connectivity (automatic sign out when idle) • Security protocols	• Third party EDI provider
Business Resumption/Disaster Recovery factors	• Backup copies • Backup rotation/transport schedule • Security of offsite storage facility	• Third party EDI provider • EDI IT Help
User resistance during roll-out	• Upper management leadership • Strategic communication • Intensive training	• Project champion

2.5. Resources and team

Resources and team – As a student, I am assigned to dedicate to the implementation of the new systems ("champion"), to ensure the project is kept on track and moving in the right direction. The responsibility of a project "champion" was:

- Assist with technology center's roll-out plan
- Convince suppliers to abide and invest in the new business systems
- Check legal requirements (Purchase Terms and Conditions, Computer Based Information Agreement)
- User account creation for internal Supply Chain team and suppliers
- Password resets for users
- Supplier and Buyer Training
- Fielding "Level 1" questions:
    - *I can't log in.*
    - *I can't print a PO.*
    - *I can't retrieve drawings or BOMs.*
    - *I can't print a barcode.*
    - *I want to change the information on my barcode.*
    - *I have missing data.*
    - *How don't get an alert when I receive a new order….*

Below is the flowchart of how I organize my daily actions as a project "champion".

Figure 11. Actions plan for EDI implementation in Enterprise E[1]

To play well this role of project "champion", one has to be influential, be able to win over resistance, and promote the project. One has to have the knowledge to understand the daily issues and processes affected. This "champion", has to have the backing at the management level, to make the team concentrate not only on the daily workload but also the requirements of the project.

The technical ability of the new systems is inevitable for a project "champion". Therefore, at the beginning of the internship, a month was taken to learn and understand the existing business processes and the new tools (see Appendix). It was a real challenge because there was no trainer initially in center C for these new tools, and I had to figure out the functionalities by myself with user guidelines, to be able to answer the particularity of each questions from new users. I would however, from time to time, address all questions that I cannot answer myself to the project global managers in the headquarter level.

However, the "champion" needs to know how to use the new systems. For the order visibility tool for example, based on the nature of the system, all internal Procurement Specialists are obliged to be involved with the system. Being in contact with suppliers, they have to adopt a positive attitude towards the change because this attitude will amplify further down to external users.

Other functions concerned would be Supplier Managers, as they are the ones to whom the technical questions from external users (suppliers) might be addressed, once my internship ends and that I am no longer in charge of the system.

2.6. User population mapping (selection of prioritized suppliers)

The first step is to identify the users to be affected by the new automated system. Vision of target user population has to be clear to provide insights on the strategy.

Starting point situation analysis was placed in the beginning of the traceability projects. Among 115 suppliers, 19 were already on Supplier Web Portal system, only 5 are using, of which only 2 are using it nearly systematically.

The study-dependent variables were "Supplier Web Portal tool use versus non-use" and "Barcode labels use versus non-use". No assessment was made in

advance to determine if suppliers had similar portals with other customers and if they had adequate infrastructure to implement it, but rather invitations were sent to prioritized suppliers. They were asked to integrate with center C's Supplier Web Portal and Barcode labeling systems, and once they agree, ensure they fulfill the legal requirements before granted access, going live and receive necessary trainings and materials.

Due to the massive number of suppliers in center C, priorities were ranked descending out of suppliers representing 80% of center C's purchase order lines and 80% of annual center C's spend. This high percentage, if succeeds, could not only save energy and become a steep ladder to make the most impact and help reach year end user rate target, but also because there is already an established trust based on dependency between these suppliers and center C that will catalysts adaptability to change.

2.7. Supplier Performance Control

An assessment of suppliers performance is made every month to measure and control the supplier's adoption to the new business systems. There are three control tools used:

1) Business Intelligence – to visualize the number of Purchase Order lines received with barcode labels, from which we could judge the percentage of supplier's adoption rate to the barcoding requirements.
2) Open Orders Report – to calculate how many open (current) orders have been received through Supplier Web Portal in percentage of total purchase orders.

Improvement actions are taken if results are not in line with targeted progress. These are such as discussing with unconvinced suppliers to engage, in a more personalized, case-by-case approach, and by conducting more trainings with suppliers.

Chapter 3

Managing the technological change

Chapter 3. Managing the technological change

3.1. Results of new systems implementation

3.1.1. Results of Supplier Web Portal implementation

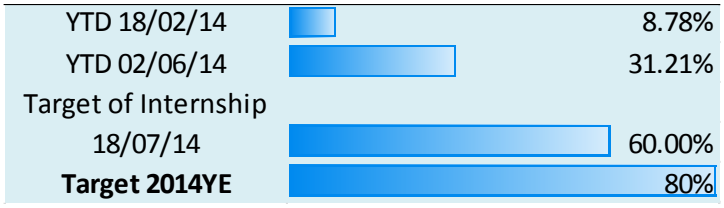

Figure 12. Purchase orders acknowledged through Supplier Web Portal[1]

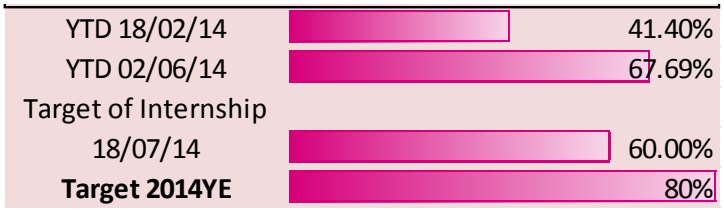

Figure 13. Suppliers with Supplier Web Portal capability (in % spend)[1]

The result obtained from the implementation of Supplier Web Portal is shown above. After the first three and a half months of implementation, as of June 2nd 2014, 31.21% of all open purchase order lines were acknowledged (Figure 11).

As of the same date, 67.69% of suppliers have submitted legal requirements and thus have the login access to the portal (Figure 12). A more intensive training is needed for these suppliers in order to achieve higher usage/adoption rate.

3.1.2. Results of supplier barcode label implementation

The result obtained from the implementation of supplier barcode labels is shown below. As of June 2nd 2014, there has been evolution of supplier barcode label adoption rate. 85.1% of purchase order lines were labeled with barcode by suppliers on that manufacturing month (June 2014), while it started with 73.1% in the beginning of the internship (February 2014).

Table 4. Percentage of purchase order lines labeled by suppliers per month[1]

	Feb-14	Mar-14	Apr-14	May-14	Jun-14
A	86.6%	86.4%	88.8%	89.9%	89.7%
B	75.5%	72.4%	80.0%	77.6%	71.0%
C	**73.1%**	**74.7%**	**74.8%**	**77.2%**	**85.1%**
D	57.0%	46.7%	55.4%	48.9%	58.6%
E	0.0%	50.0%	72.1%	73.3%	61.0%
F	59.5%	63.7%	62.5%	62.7%	71.1%
G	67.9%	66.1%	69.6%	67.7%	70.6%
Total	**74.1%**	**73.8%**	**76.5%**	**75.3%**	**78.2%**

Table 4 also shows that center C has reached above the targeted 80% of year-end supplier barcode labeling. By June 2014, it was the best performing center in terms of product traceability (supplier barcoding), second to center A in Japan who tops the list with 89.7%.

Following cut-over to live operation with the initially targeted trading partners, the next stages in due course should include extending the barcode implementation to a wider group of suppliers.

3.2. Developing best practices to drive adoption

During implementation, one thing to highlight is that it is not simply about the use of the new system, but the reasons behind why such new systems are undertaken have to be elaborated to meet the needs of the business. Here is where an interpersonal skill of a project "champion" is needed to persuade others to adopt the change. The project "champion" should be able to communicate to raise awareness, to give context sensitive help, telephone/face-to-face support, and ongoing hints and tips.

As a project champion, I created a list of best practices to successfully implement EDI (electronic data interchange) with suppliers, gaining end-user adoption:

1) Define your desired results, set and share clear, measurable goals
2) Give reward/say thank you for collaborating
3) Assemble and maintain the competent project team
4) Stakeholder involvement – Communication plan
5) Make user training a priority – Training strategy
6) Ensuring getting the right data into the system
7) Participation and leadership of upper management
8) Coordinate with ITHelp and EDI third party provider
9) Continuous improvement

3.3. Lessons learned

The massive list of Enterprise E's suppliers from all over the world offers valuable insights about how technology in communication can be harnessed for a complex network.

During the dialogue and implementation of the two technologies among suppliers, several things were discovered. Among those are:

- **Capability to provide goods with certain specifications will get the supplier selected, but an alignment with the buyer's business systems will get good prospective long term relationship.** The demonstrated capability of a supplier to meet product specifications at a competitive cost is enough to create a market linkage, but the sustainability of the buyer-supplier relationship requires more than just delivering a product at a given price. From the buyer's perspective, if a procurement decision is only based on cost, then as new supply options emerge, there will frequently be a cheaper supplier producing equal or better quality. To maintain its competitiveness, the supplier needs a full understanding of the buyer's business model, a comprehensive set of competencies to serve that business model, and favorable conditions in the business environment.

- **Buyers often do not understand the production capacities and business environment of a particular supplier and so impose new business systems that are not aligned with local conditions.** Similarly, suppliers rarely understand the end-market needs and trends for their products and so are not fully aware of the buyer's business systems. One example, there are at least three suppliers who refused to adopt the supplier barcode labels because they outsource the production and it is located in a different country of where they are. Therefore, these suppliers do not rely on giving the authority to the outsourced parties to print Enterprise E's barcode labels. In this situation, it is difficult to engage suppliers. The temporarily used palliative action for this case is to print the barcode once it arrives at center C. Some solutions/alternatives remain to be discussed with suppliers for long-term plan.

3.4. Recommendations

One important thing I find that was not included during my internship mission was to do a Regression Test of the existing processes when introducing change. For example, consider if Supply Chain department is successfully placing orders through Supplier Web Portal, and one now wants to start accepting electronic orders and invoices, as a project champion, I should not only test that the orders and invoices received work but I should also test that the standard ordering process is in no way negatively impacted by the new changes. Regression testing is designed to test whether unexpected problems have been introduced to what may appear to be unrelated areas[21].

It is believed that the two collaborative portals have long term benefits to a business that are clearly defined, and as such, much easier to justify than many information technology (IT) projects. To prove that the investment worth made in enhancing product and process traceability, however, a profit analysis should be made. This was done in the earlier phase prior to implementation by Enterprise E. However, a post-implementation verification is needed to see if ROI

is aligned with the estimated one. The profits and cost saved divided by the costs of professional services (i.e. project management, training and technical support) needed to implement new automated business systems, custom development costs, and the hidden costs such as travel costs, travel time and project management time. Hardware and infrastructure costs are to count as well.

To ensure the continuity of project especially after goal is achieved, it is essential to create a project team. Firstly, Enterprise E will need to identify a project champion in the company, and then build a support team of well-trained supply chain personnel. This internal team should definitely include the IT department to ensure that the two portals can integrate well with the company's ERP. Enterprise E will need to ensure that the supplier is capable to provide multi-source to multi-destination integration from back-office systems, secure data infrastructure and a dynamic supply chain community. In the contrary case, Enterprise E will have to find a back-up plan, it could be subsidizing the already existing suppliers to enable them to adapt with the technology requirements, when the benefit is greater.

The last essential point is, after all, beyond costs spent to adaptive integration of IT into operational business, there is greater visibility that leads to better management and measurement of the effectiveness and productivity of the whole supply chain system. This one vision has to be acknowledged by every internal and external collaborators to create a climate of change. So instead of suppliers and supply chain professionals wasting a lot of energy in fighting each other, to resist change, they instead use this energy to work with each other on this win-win concept to deliver results in a more efficient and effective way. This needs the right vision about how operations can be better, how everyone can excel in their work with IT fusion, the right vision of what technology innovation can truly do to the organization's quantum leap.

Other Activities

Although the main and most important missions to be taken care of were to implement order visibility tool and barcode labels, on the course of the internship I also got involved in other activities related to my study:

1) Internal Audit
2) External Audit

To have a first practical experience in audit, of which the theory was taught throughout the audit course at UTC, I offered to be involved in an internal and an external audit. To ensure I have uniformed audit training with the other employees, I had the privilege to be coached by the Quality Champion of Enterprise E's center C. I was then trusted to lead an internal audit, to verify the compliance of Center C's engineers, purchasers, warehouse team, and accountants for an internal procedure. I was also one of the five engineers to audit the activity of a local supplier. The results of the audit are excluded from this MIM.

Aside from that, I also had the chance to travel and visit other suppliers' workshops, as an observer during Supplier Quality Reviews. This has given me a more specific idea on how supplier-buyer relationship works, and how supplier performance and quality reviews are essential upstream activities that contributes to the success of the company.

Conclusion

On the whole, this internship was an enriching, intellectually stimulating experience. I have gained new knowledge, skills and met many professionals of 20 nationalities, mostly engineers, who are highly qualified in their fields yet humble and ready to dedicate at least 50 working hours per week. My next mission will be to keep learning to answer these questions.

I got insight into professional environment. I learned the different facets of working within a large company, in one of its technology centers, the existing needs and challenges to accomplish its projects. I learned how to lead projects of an intercultural, interdisciplinary, intergenerational, and international team.

I observed that internal and external communication, as in many organizations, is an important factor for the progress of projects. I also learned how to deal with people resistance to change, and how to convince others to collaborate in projects that first might not seem to have immediate benefit to them. Because of the nature of the projects, I am also now more confident in initiating communication with trading partners using multiple languages.

The internship was also good to find out what my strengths and weaknesses are. This helped me to define what skills and knowledge I have to improve in the coming time.

Throughout the internship, I have gained two kinds of competencies (see Appendix):

1) Foundational Competencies
2) Profession-related competencies

The experience also brought *continuous improvement* to internalize my mindset and working culture, like the figure below.

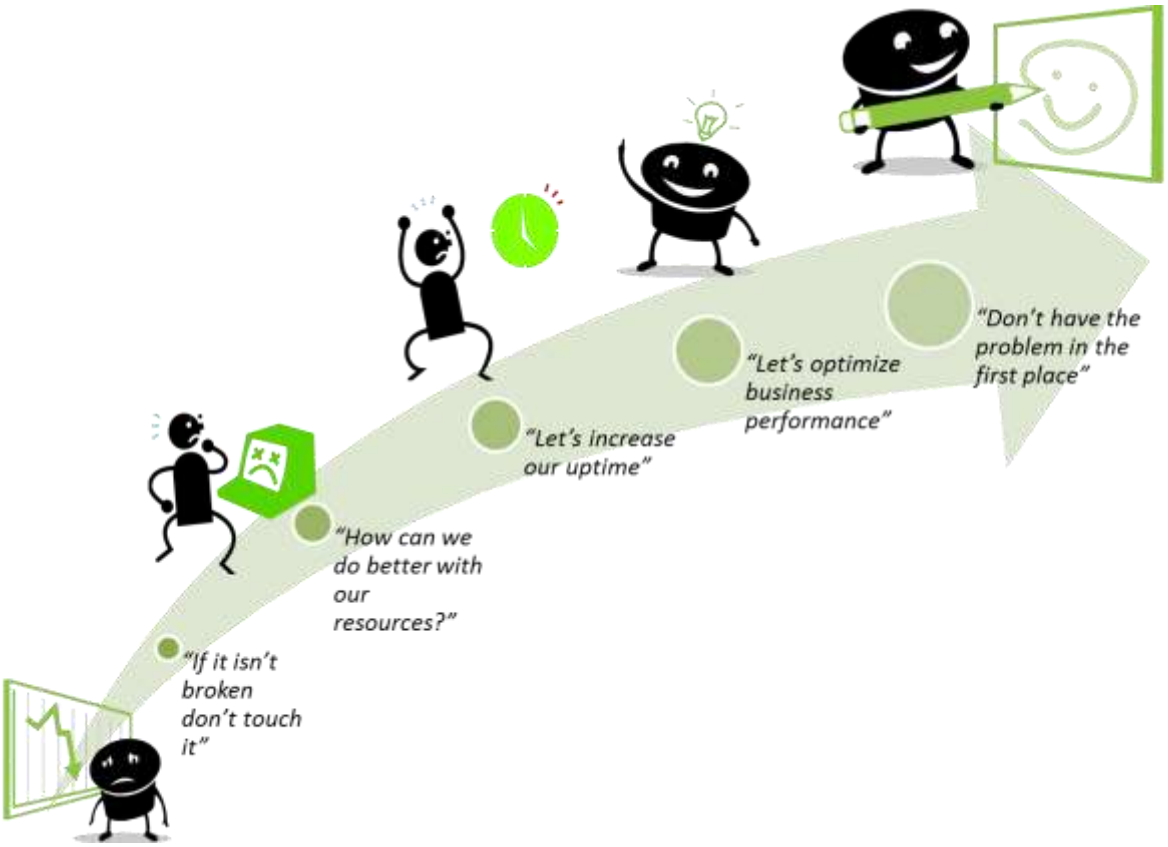

Figure 14. Developing the continuous improvement attitude[1]

As for today, I am more determined and convinced to pursue career in Quality and/or Supply Chain, not because I feel I am already good, but rather because the more I observe new aspects these two domains, the more curious I become about the subject, the more I believe there are still a lot to learn. This becomes a challenge I would like to answer.

Last but not least, the internship was a great opportunity to expand my professional network which may prove value in the near future.

My competence, knowledge, and aptitude is now strengthened and consolidated, and therefore I am eagerly looking forward to soon become an independent, ethical and responsible professional in the domain of Quality and Supply Chain.

***

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Appendix

The competencies I gained throughout the internship:

1) Foundational Competencies

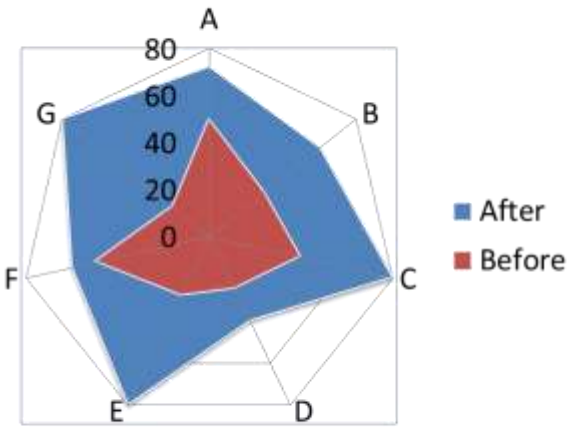
Personal Effectiveness	Academic Competencies	Workplace and Leadership Competencies
• Awareness of the needs of others • Integrity • Continuous learning • Effective communication • Interpersonal skills • Creativity	• Analytical thinking and data interpretation • Reading and writing for comprehension • Supply chain fundamentals • Foundations of business management	• Problem solving and decision making • Teamwork • Accountability and responsibility • Customer focus (internal and external) • Planning and organizing • Conflict management • Enabling technology

2) Profession-related competencies

Quality Management	Supply Chain Management
• Delivering Quality Strategies and Plans and Goals • Design and Deployment of Management Systems • Providing Independent Assurance • Business Improvement	• Strategy development and application • Supply chain management • Process improvement and six sigma • Execution planning, scheduling, and control • Project management • Lean management • Enabling technology application

Below are my profession-related competencies in Supply Chain translated into radar graph, showing the difference before and after internship. I am privileged to have been given opportunity for five months to experience first-hand tackling real-world cases upon the completion of the internship.

Legends	
A	Strategy development and application
B	Supply chain management
C	Process improvement and six sigma
D	Execution planning, scheduling, and control
E	Project management
F	Lean management
G	Enabling technology application



The above graph, however, is my auto-evaluation respective to my subjective targeted scale. I did not compare myself to anyone else's competence, but rather to myself. I realize there is still a lot to discover and to improve.

Internship timeline

No	Assignments	Feb	Mar	Apr	May	Jun	Jul
1	Learning supply chain processes in Enterprise E						
2	Learning to master the EDI tools						
3	Selection of best methods						
4	Inviting suppliers to integrate						
5	Collecting legal requirements						
6	Creating new EDI accounts for suppliers						
7	Training suppliers (conference call, online, face-to-face)						
8	Daily monitoring of EDI adoption rate						
9	Other activities: internal and external audits						
	Estimated period to accomplish assignments						
	Closing						

Implementation of Electronic Data Interchange by Suppliers as solutions to enhance Traceability in upstream Supply Chain

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Abstract

English Version

Background - Visibility and traceability are vital to build an effective upstream supply chain management. As the volume of companies' purchases increase, process automation has been seen as a mean to provide accurate traceable information and a more efficient coordination, thus contributes to various long term competitive advantages.

Purpose – In this paper, the traceability issue will be addressed by focusing on the different flows of information that can be automated. This paper also demonstrates the implementation of new business systems among supply chain department and suppliers of Enterprise E to improve traceability.

Methodology - Using a combination of three technological change approaches, EDI (electronic data interchange) was introduced to suppliers of Enterprise E: 1) Supplier Web Portal to facilitate purchasing process traceability, and 2) barcode labels to facilitate product identification in the warehouse.

Findings - From the obtained results, it is interesting to point out also the challenges faced during the transition and adoption of new collaborative business systems.

Value – This paper adds to the growing literature in the supply chain automated business systems.

Keywords – traceability, business process automation, upstream supply chain, barcode, EDI (electronic data interchange)

French Version :

La mise en œuvre de l'Echange de Données Informatisées aux fournisseurs pour la traçabilité en amont de la chaîne d'approvisionnement

Contexte - Visibilité et traçabilité sont essentielles pour construire une gestion de la chaîne d'approvisionnement efficace en amont. Comme le volume d'achats augmente de plus en plus en entreprise, l'automatisation des processus a été considérée comme un moyen de fournir des informations précises et traçables ainsi qu'une coordination plus efficace, fournissant ainsi divers avantages concurrentiels à long terme.

But - Dans cet article, la question de la traçabilité sera adressée en mettant l'accent sur les différents flux d'informations qui peuvent être automatisées. Ce document démontre également la mise en œuvre de nouveaux systèmes d'affaires entre le département supply chain et les fournisseurs de l'entreprise E pour améliorer la traçabilité de la chaîne d'approvisionnement.

Méthodologie - En utilisant une combinaison de trois approches de transition technologique, EDI (échange de données informatisées) a été mis en place avec les fournisseurs de l'entreprise E: 1) Supplier Web Portal pour faciliter la traçabilité du processus d'achat, et 2) les étiquettes de codes à barres pour faciliter l'identification des produits dans le magasin.

Constatations - D'après les résultats obtenus, il est intéressant de souligner aussi les difficultés rencontrées au cours de la transition et l'adoption de nouveaux systèmes d'affaires collaborés.

Valeur - Ce document s'ajoute au développement croissant de la littérature sur les systèmes d'affaires automatisés de la chaîne d'approvisionnement.

Mots-clés - traçabilité, automatisation du processus d'affaires, chaîne d'approvisionnement en amont, code à barres, EDI (échange de données informatisées)

Indonesian Version:

Pelaksanaan *Electronic Data Interchange* oleh pemasok sebagai solusi untuk meningkatkan trasabilitas rantai pasokan hulu

Latar Belakang - Visibilitas dan trasabilitas adalah unsur penting untuk membangun sebuah manajemen rantai pasokan hulu yang efektif. Seiring dengan meningkatnya volume belanja suplai perusahaan, otomatisasi proses dipercayai sebagai alat untuk memberikan informasi yang akurat dan bisa dilacak, serta koordinasi yang lebih efisien, sehingga berkontribusi memberikan berbagai keuntungan kompetitif jangka panjang.

Tujuan - Dalam makalah ini, isu trasabilitas akan ditangani dengan berfokus pada arus-arus informasi yang dapat diotomatisasi. Makalah ini juga mendemonstrasikan penerapan sistem bisnis baru antara departemen rantai pasokan dan para pemasok Enterprise E dalam rangka meningkatkan trasabilitas.

Metodologi - Dengan menggunakan kombinasi tiga pendekatan perubahan teknologi, EDI (*electronic data interchange*) diperkenalkan kepada para pemasok Enterprise E: 1) *Supplier Web Portal* untuk memfasilitasi trasabilitas proses belanja suplai, dan 2) label *barcode* untuk memudahkan identifikasi produk di gudang.

Temuan - Dari hasil yang diperoleh, menarik untuk mendiskusikan juga tantangan yang dihadapi selama masa transisi dan penerapan sistem bisnis kolaboratif yang baru.

Nilai - Tulisan ini berkontribusi pada pertumbuhan literatur yang berkembang mengenai sistem bisnis otomatis rantai pasokan.

Kata Kunci - trasabilitas, otomatisasi proses bisnis, rantai pasokan hulu, *barcode*, EDI (*electronic data interchange*)