

POLITECNICO DI MILANO
Scuola di Ingegneria dei Sistemi



POLO TERRITORIALE DI COMO

Master of Science in

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Work On Supply Chain Management at Evonik Industry

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Abstract

Within my Management Engineering study I am interested in supply chain and logistic topic. It was a great opportunity for me to do these 7 months internship in Germany within Evonik industry. This thesis is based on the internship at the Technology Engineering – Supply Chain division. This work focuses on the optimization of the sub-process in supply chain management. Which includes developing analytic tools, developments and recommendations are provided in the report of overall strategic decision process.

The technology engineering department is divided into two topic team: supply chain consulting team, 6- sigma team, I was allocated in supply chain team giving my master study contents and my future career plan.

At the beginning of my internship, my main task in the team was to assist the supply chain consulting member to finalize the project report they have been doing, collect useful information from industry whitepaper and support the project optimization report. Later on I also assisted on the delivery performance KPIs and 6 sigma- China curriculum change management on the culture issue.

In this project report I will mainly describe and make summary of two main jobs among them:

1: Work on optimization report:

The supply chain team mainly works on project basis, which means they work on all the optimization topic and training or curriculum for different site and business unit (later refer as BU) within Evonik global. The process usually starts with understanding the customers' main supply chain processes, collect data, analysis data, conduct interview, providing possible solution, and provide continuous plan.

2: Work on supply chain and 6-sigma China curriculum:

The training and curriculum which will be given to China Evonik in 2014 is based on the success project that always done in Germany and America, the requirement for China is to adapt the change management, consider the supply chain environment and economic situation in China, combine with the cultural, justify the training contents accordingly.

At the beginning of the internship I had set several learning goals regarding the improvement of knowledge and skills on supply chain and logistic topics and also soft skill of working in an international environment. These goals made my internship position a valuable work experience. The objectives are:

Objective 1: Understand critical process in supply chain in a worldwide trade company.

Objective 2: Learning basic sub-process in supply chain operation.

Objective 3: Understand basic principles and concepts of European supply chain.

Objective 4: Understand the different parties that involved.

Objective 5: Understand the supply chain trading issues between European and China.

In conclusion, the internship was a very useful experience. I have find out what my strengths and weaknesses are; I gained new knowledge and skills and met many new people. I achieved many of my learning goals, however for some the conditions did not permit to achieve them, as I wanted. (Due to the project language limit, part of the project is required in German language, and some was limit for intern to authorized to work on the confidential data)

I got insight into the work of supply chain consulting. The financing of projects is an important factor and forces to be flexible in attitude and approach. I learned more about the new trends in the supply chain process in global and the risks that are facing. Working together with the different nationality coworker and learn the different mindset of same topic in different country. There is still a lot to discover and research methods can be improved.

At last this internship has given me new insights and motivation to pursue a career in supply chain and logistic abroad. To prepare myself for my future career I can improve several things. I can work on my communication skills so that I am able to present and express myself more confidently. I could perform certain tasks in research better if I have more experience in the research methodologies applied in supply chain.

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1 Introduction

1.1 Evonik

Evonik Industries is an industrial corporation headquartered in Essen, North Rhine-Westphalia, Germany, one of the world's leading specialty chemicals companies, owned by RAG Foundation. It was created on 12 September 2007 as a result of restructuring of the mining and technology group RAG. Evonik Industries united the business areas of chemicals, energy and real estate of RAG. Its chemicals business already generates more than 80% of sales in areas in which it ranks among the market leaders. In 2012 Evonik's roughly 33,000 employees generated sales of €13.6 billion and an operating result (adjusted EBITDA) of €2.6 billion. 75 percent of sales are generated outside Germany, providing convincing evidence that the business is global.

1.2 Department overview

Process technology and engineering department

The Service-Unit Process Technology & Engineering provides innovative engineering services for the Chemicals business area of Evonik Industries – from developing new processes to engineering and construction management of new plants – in Germany and worldwide.

As a company with global operations and a recognized world leader in the field of specialty chemicals, Evonik draws on a wealth of experience in process technology, on which the commitment in the biodiesel market is based. The network and pool this knowledge in Process Technology & Engineering unit. The services and solutions, often developed jointly with research institutes and universities, provide the input for developing new technologies, methods and processes—as well as for further process and cost optimization. The first to

benefit from these achievements are their customers and partners: from troubleshooting in biodiesel production all the way to cost-effective capacity expansion for the fast-growing biofuel market. **The know-how for improving plant and equipment efficiency** Process optimization is a key aspect of our work in the biodiesel field. Our goal is to keep making biodiesel facilities more cost-effective and more productive. Our competency areas range from the use of new oils to the optimization of individual reaction and separation stages in existing biodiesel processes to achieving 20 percent to 30 percent capacity gains cost-effectively by eliminating bottlenecks in existing plants.

The core competency in Engineering lies in engineering and constructing production plants—in Germany and abroad. In the field of biodiesel, the focus is on optimization measures such as eliminating bottlenecks. Services comprise:

- Project management, including quality, cost and schedule control
- Engineering, including feasibility studies, basic and detail engineering
- Specialized services, from equipment technology to production logistics
- Construction and assembly management
- Operational support and personnel training

Furthermore, the vision of the department is as following:

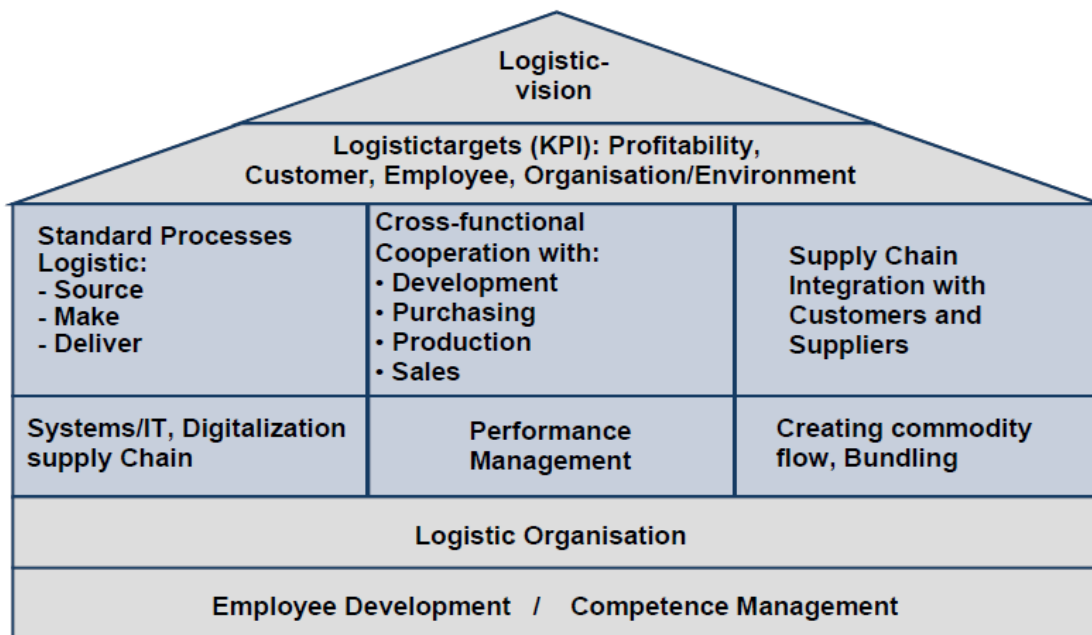


Figure 1 Department vision of Process Technology in Evonik

1.3 Objectives and scope of project

The supply chain team has just done some project of inventory optimisation of a France site in last year, this year they begins some new business/cooperation with new sites and business unit on order to cash, S&OP, logistic optimization topics.

The internship activities in detail:

- ✓ Helping supply chain staff to insert the information from the interview that was conducted.
- ✓ Search for whitepapers and best practise from chemical or other industry on the topics.
- ✓ Translation and adjustfy the training content for China Evonik
- ✓ Establish the delivery performance KPI for maketing approach with American team, mainly on developing fishbone chart.
- ✓ Develop the topic of hidden cost in supply chain between the trade of China and European

- ✓ Develop the order to cash optimization report together with coworker, mainly focus on the work package review steps, roadmaps and order to cash cycle KPIs
- ✓ Develop inventory optimization work package roadmap
- ✓ 6-Sigma training content consulting in China business unit

2 Activities Methodology

2.1 Methodology: Literature review

The study in this thesis is based on a lot of literature and understanding combined with practical problems which company may faces. Throughout the study, several research methods are applied. Such as literature review, data analysis, etc.

1) Literature review

In order to obtain comprehensive, in-depth understanding into the research status about the supply chain framework, inventory optimization, logistic optimization, S&OP, order to cash process, delivery performance and related fields, and also to provide sufficient theoretical references for the thesis, the author did a lot of reviews on data, literature, white paper and journals from worldwide range. The information and materials are mainly from collection of books and literature from universities libraries of China and Politecnico di Milano, as well as research result from public internet, including outstanding master and PhD theses, best practise consulting report, Wanfang Data, etc.

2) Data analysis

The data analysis and processing in this thesis focuses on the item analysis on the best practise and KPIs. The goal is to obtain ranking of the importance weight and convert them to an optimization guideline.

3 Inventory optimization

“The most successful companies are constantly adapting themselves to a new regulatory environment and are innovating by making the most out of technology to achieve significant reductions in working capital. A good example here a supply chain finance programmes, even though these are far from new, there is strong renewed interest from companies to evaluate possibilities in this area. Making the most of accounts payable processing technology allows companies to create a ‘win-win’ situation, as the supplier gets paid within short timeframes and the company benefits from extended payment terms.” PwC 2013

A NWC project usually includes an inventory optimization project and be influenced by most of the Supply Chain themes (strategy, segmentation & service level, performance management, networking design-logistic, S&OP) while offering a detailed insight on the financial level (payables & receivables-Order to cash).

After an overview of Net working capital, my task is to focus on the sub activities of the framework. We first review inventory optimization, and come out strategies for eliminating Stock-outs and Over-Stocks

3.1 Definition of research problem

“An important key to success in supply chain management is the optimization of inventories, because stock surplus quantities result in an increase in costs and lower profit margins, while inventory bottlenecks cause problems in production and poor service levels [...]. Decisions made regarding inventory management can have a direct influence on the success of a company. Few years ago, it was generally assumed that a high volume of stocks guaranteed a successful future for the company. Today, increasing costs force companies to reduce their inventories and warehouse stocks. Therefore, the optimization of a company's inventory becomes an increasingly important tool for helping companies to save costs.”

Inventory optimization project should answer difficulties introduced by the growing complexity of Supply Chains such as demand and production volatility or the constant need to reduce operating costs while improving the customer service levels. Companies implementing inventory optimisation projects can typically expect up to 10 to 30% reduction of their inventory value and achieve greater visibility across their supply chain. Meanwhile it should be possible to develop a 20% to 35% more accurate demand forecast.

3.2 Process steps

We first establish the timeline of the critical steps of the optimization, and based on the timeline develop the roadmap and detail the working package.



Figure 2 Timeline and working package of inventory optimization project

After we decide the timeline and communicate with the steering member, the project officially started. To move to the first step of “Preparation”, the key activity is to collect the background information, the background information is the key starting point for the data which will be needed later for all the analysis.

Data quality is critical for the project, most of the information should be available in SAP but without the right quality of data we will not be able to conduct a proper analysis or might lose a lot of time. Here are the most important data that should request (list is not exhaustive):

- ✓ revenue per product reference and volume of sales
- ✓ margin per product reference
- ✓ customer and/or product segmentation
- ✓ current stock per product reference
- ✓ lead times (products & raw materials, consumables, packaging)
- ✓ sales forecast (historical values)
- ✓ rotation rate (raw materials, consumables, packaging)
- ✓ BoM (to link raw materials to finished products)
- ✓ current level and calculation of safety stocks
- ✓ current MRP (SAP) types being used (if sourcing planning)
- ✓ current process concerning blocked stocks
- ✓ detailed view of blocked stocks
- ✓ tank capacity (if definition of cycle stock wished)
- ✓ campaign size
- ✓ transport volumes (if definition of cycle stock wished)
- ✓ lot sizes per reference
- ✓ production planning
- ✓ capacity
- ✓ OEE data if available

After finishing collecting the background information we moved to estimate the potential, hence, choose the KPIs can give the team idea about what part should be focus and to be able

to show the evolution of the situation before, during and after the project. Here are the examples of KPIs used in inventory optimization projects:

- ✓ Stock value
- ✓ Stock coverage (or DIO - Days Inventory On-hand)
- ✓ Safety stock compliance

Calculate the potential can give us the opportunity to have the first picture of what should be out quick win and long term strategy, and also as the process move on, it will have the reference for changing the goal and strategy. After the KPIs are decided, it will be an optimum solution to start to use some of the KPIs as cockpit and then conduct the communication with the BU.

3.3 Analysis --- Finished product

After knowing the potential of the project, the next step is to conduct the analysis. The analysis is the most important step in the optimization report, and we analysed finished product, raw material and spare parts.

It was first advised to perform an ABC-XYZ analysis for the different segments in order to have a global view of the portfolio.

ABC/XYZ analysis is a method of grouping planning objects (characteristic value combinations, SKUs) based on their value (revenue or sales volume) and dynamics of consumption or sales. During the analysis, the planning objects are assigned one of the classes of ABC and XYZ simultaneously.

Analysis based on value (ABC analysis) can be done by applying Pareto's rule on the value of individual items in a specific time horizon. The analysis ranks planning objects according to their value contributions in terms of sales or contribution margin.

Analysis based on the dynamics of consumption (XYZ analysis) means the calculation of a variance coefficient of consumption or sales in a specific time horizon. For example, a planning object that has the values BY might mean a planning object with medium volume, and trend or seasonal demand.

ABC Analysis

We perform an ABC analysis to classify planning objects according to their usage value, or number of objects. During ABC analysis, the system assigns each object one of the following indicators:

A - The most value, or given number of objects that produce the greatest value

B - Less value, or given number of objects that produce less value

C - The least value, or given number of objects that produce the least value

XYZ Analysis

We perform an XYZ analysis to classify planning objects according to the variance in a specific coefficient. During XYZ analysis, the system assigns each object one of the following indicators:

X - Very little variation

Y - Some variation

Z - The most variation

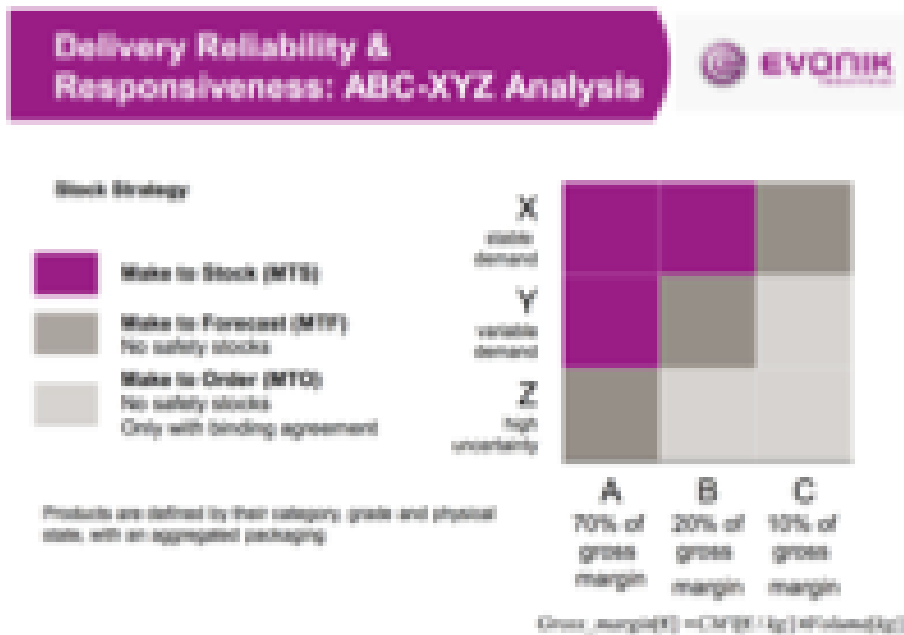


Figure 3 ABC-XYZ Analysis to define delivery reliability and responsiveness

Thanks to this analysis and the lead times we gathered the background information, we then calculate the safety stock. We choose to differentiate the service level or to keep the same for all safety stocks depending on the business model.

The safety stocks can now be calculated thanks to this formula:

$$z(LBG) \times \sigma_{demand} \times \sqrt{\text{Replenishment_time}}$$

3.4 Analyze --- Raw material and finished products

An analysis of these materials should be based on 3 main aspects:

- ✓ Link to the product's strategy
- ✓ Criticality/risk analysis
- ✓ Rotation rate (use of current stock)

The best way to assess a criticality analysis for those different parts is to organise a workshop with the head of procurement, head of production and the supply chain manager in order to describe the criticality of all the raw materials, consumables, spare parts and packaging.

Based on those analyses we now be able to estimate the safety stocks for all materials.

3.5 Results

Among the potential we defined before, then we have to describe what is to be done on a short term basis (quick-wins) and what will still have to be completed after the end of the project (long term & sustainable potential).

For inventory optimization projects, typical quick-wins will be reduction of stock through stock sales and devaluations. Depending on the situation a new blocked stocks process and the use of optimum INCO-terms might be part of quick-wins as well. At this point of the project potential will be final and be communicated as the official target. The project has now be thoroughly studied and is ready to enter the implementation phase.

4 Order to cash optimization

4.1 Definition of research problem

“Cash is the lifeblood of companies. By optimizing working capital, companies can effectively support their people, processes, and tools to drive business growth. Yet, the desperate need for resources often prompts companies to collect payments from customer earlier, more aggressively, and / or without much strategy around maintaining customer loyalty – the true element of sustaining and growing a business.”- Receivables management for the long term: balancing collections and customer service, Aberdeen group, 2012

The last few years have seen unprecedented economic challenges for today’s company such as the Euro-crisis, double dip recessions and banking crisis. Cash has become an expensive resource more and more difficult to obtain. Most companies have trapped cash sitting on the balance sheet and, as one of the cheapest sources of finance, it makes sense to squeeze as much cash as possible from working capital before seeking additional external financing; a move that reduces the need for financing and is likely to be looked upon favourably by

lenders. As a consequence working capital management and cash flow forecasting are at the top of the agenda for many supply chain executives.

Order to cash project should meet the challenges introduced by the growing complexity of Supply Chains such as price pressures, cost pressures, increasing stakeholder value and customer experiences improving. Among all the challenges, cost reduction is always on the minds of decision – makers, but customer demand to improve service level concern loom large. The evolution of client and supplier relations has moved from price-only, transaction-based relationships to strategic alliances. Thus, a better integration of order to cash process enables more efficient inventory control, reducing carrying costs and resulting in higher profit.

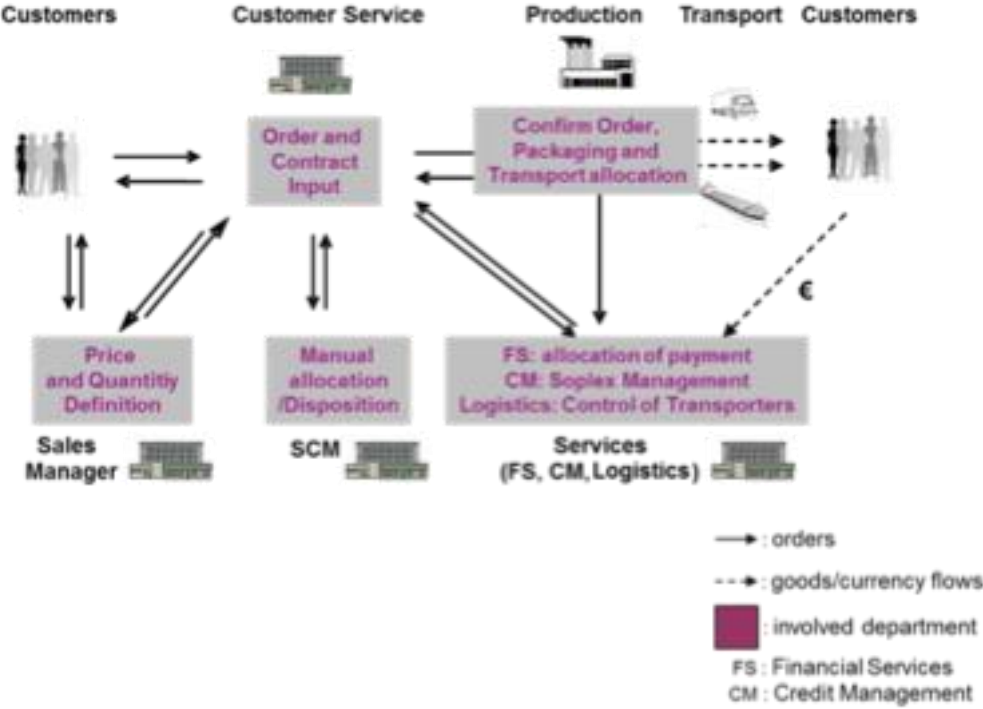


Figure 4 Interfaces between different departments occur in the order to cash process

4.2 Process steps

Similar to inventory optimization, order to cash optimization also will have its own timeline, and the main steps are also the same. In Evonik, the goal of this department is to standardize the general optimization documentation, which means all the optimization should follow the

similar timeline, of course depends on different project; the analysis step should be based on the exactly case. In this part, the timeline will not be repeated described.

4.3 Potential definition

Potential definition process is very important in the whole optimization process. Choosing the right indicator can only lead us to the right analysis later on. Within the order to cash potential definition, I focused on the listed part:

- ✓ Reducing Days Sales Outstanding (DSO)
- ✓ Automation: OCR
- ✓ Centralization & Decentralization, customer service, and payment collection function
- ✓ Reporting tools and tracking systems
- ✓ Improve customer satisfaction by providing self-service access

Among the list, automation and reporting tools is the new trends that Evonik is moving into.

Digitize all incoming documents Paper, electronic documents and document images are all streamlined into the correct format.

Sales order automating processing module uses Optical Character Recognition (OCR) technology to automatically identify and extract the relevant order and customer information from incoming purchase order documentation and transfer it to the ERP or finance system, allowing orders to be processed swiftly. Digitize all incoming documents Paper, electronic documents and document images are all streamlined into the correct format. Automate the paperwork Improve the general control, compliance and service levels.

Automating order-to-cash document processes improves cash availability by decreasing the number of touch points at each step of the cycle



Figure 5 Automation in order to cash process

Tracking goods moving through the supply chain can provide total supply chain visibility. This makes it possible to shorten the order-to-cash cycle, detect and resolve delivery exceptions, prevent out-of-stock situations, and pinpoint affected product in a recall, while minimizing inventory and safety stock levels (see chart, “RFID’s Impact on the Order-To-Cash Process”).

RFID’s Impact on the Order-to-Cash Process

RFID Data	Process Step	Improvement
Retailer’s product availability data generates an automated – and more accurate – purchase order	Order Capture	More accurate ordering means less inventory in supply chain and lower carrying costs
Manufacturer’s shipping and receiving data can be used to locate inventory in the supply chain	Order Routing and Tracking	Incremental benefits can be limited when bar coding already does a good job and instant data is not required
	Order Fulfillment	
Manufacturer’s shipping data creates more granular ASNs that include case EPCs	Shipping	Customer service levels increase with higher shipping accuracy
Manufacturer’s shipping data generates invoice that includes case EPCs	Billing	Fewer instances where shipment doesn’t match invoice
Retailer’s receiving data generates receipt of goods that includes case EPCs	Payment Receipt	Invoice and receipt can be checked against one another for greater accuracy and less administration time

Source: Forrester Research, 2005

Figure 6 RFID impact on the order to cash process

Besides the technical change that Evonik want to achieve for the optimization, another social issue is also be highly focused: Centralization/Decentralization of customer service and

payment collection function. Choosing to centralize or decentralize OTC processes often represents a trade-off between efficiency and customer satisfaction. Centralized OTC processes (with shared services centers or at the group level) deploy less labour to complete those activities. On the other hand, if distribute the OTC activities among company subsidiaries, or BU, higher customer satisfaction will be reported.

Potential calculation:

In order to cash optimization, the potential can be calculated by some KPIs, in the project I combined the most important performance indicators and the Evonik business unit customer requirement, decide the listed potential calculation indicators:

- DSO & CEI

Target 1: Measuring Collections Performance

DSO is calculated as:

DSO ratio = accounts receivable / average sales per day, or

DSO ratio = accounts receivable / (annual sales / 365 days)

Collection effectiveness index (CEI)

CEI expresses the effectiveness of collection efforts over time, the closer you are to 100 percent, the more effective your collection effort.

$$\frac{\text{Beginning Receivables} + (\text{Credit Sales}/N) - \text{Ending Total Receivables}}{\text{Beginning Receivables} + (\text{Credit Sales}/N) - \text{Ending Current Receivables}} \times 100$$

N = Number of months or days in the period you are assessing.

In the optimization report, another important task for me is to define the calculation method and describe the steps, the basic calculation method usually comes from the definition which is already accepted by the industry and been widely used, my part was to take the basic method and put into Evonik practical business. For example, in the DSO calculation, we don't use the number of single days, but use 90 days and 3 month as our calculation unit.

Target 2: Measure customer satisfaction:

Customer satisfaction will be calculated based on two main parts:

✓ Survey/ Feedback

✓ Complaint

The important step here is that I collect all the data based on the survey and feedback the BU (business unit) or BL (business line) received from the customers. And we defined the “must ask” questions for the survey:

- 1. Describe the components of the measurement process. (e.g. survey customer on product quality, delivery service level, lead times, product availability, satisfaction with freight carrier, shipment accuracy, consolidate responses and calculating a customer satisfaction rate)
- 2. Approximately how often does the product delivery date meet or exceed the customer's delivery expectation?
- 3. How often does the product meet or exceed the customer's performance expectation?
- 4. Why would the customer not pay the invoice on time?
 - Invoice price different than quoted price
 - Product not performing to expectation
 - Customer normally does not pay within term limit
 - Other

- 5. What factors do customer consider most important when deciding to purchase?
 - Price
 - Product quality
 - On time delivery
 - Product durability
 - Customer service experience

4.4 Definition of project's KPIs

In order to be able to show the evolution of the situation before, during and after the project we have to be able to measure the parameters (CTQs). Here are some examples of KPIs used in order to cash optimization projects:

- ✓ Days sales outstanding
- ✓ Order processing cycle time
- ✓ Order to fulfillment cycle time
- ✓ Order to cash cycle time

Process steps are evaluated on the basis of KPIs:

Example:

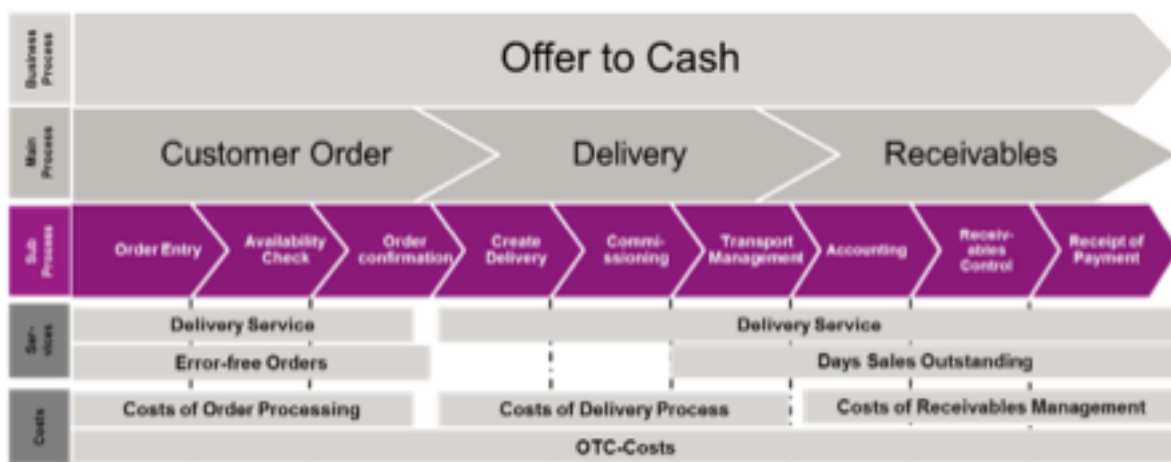


Figure 7 KPIs in different order to cash process

4.5 Analyze --- Customer service segmentation and differentiated service level

Customer complaints are most often attributed to language barriers and delays in getting issues resolved which result in frustrated and dissatisfied customers.

OTC projects have come to value customer language and time zone compatibility and at certain level of trading off some of the cost-saving benefits from offshore solutions for better service and higher customer satisfaction that comes with onshore or near-shore alternatives. For OTC, where customer satisfaction is critical, it's expected to see the interest in onshore and near-shore customer call centers increase. This includes solutions designed with separate, but highly integrated front-office (same or near-shore) and back office (offshore) arrangements that provide seamless communication and processing capabilities.

Based on a clear understanding of customers' needs and their value to the company, thus offering customers different service level can give the plant the opportunity to avoid problem of growing costs and increase profitability by 2 to 10 percent.

Key steps:

✓ Define interaction models

1: lean model: based largely on web transactions and standard offerings. This is designed to serve customers who are price sensitive, interested in limited supplier relationships and tend to buy on spot market.

2: Innovation emphasize customers: the interaction model focuses on

The model definition should not be based on the experience of sales or marketing, but rather careful surveying of customers themselves to identify what they need and value.

✓ Analyze and segment customer portfolio

Analyze each customer's attractiveness to business unit in two dimensions: current attractiveness (based on factors such as profit margins, sales growth and loyalty),

future attractiveness (based on factors such as potential growth in demand from customer, or potential for partnering to create future products.) Customer segments need to be actionable: a given customer should not be in several different segments, nor should there be so many segments that it is impractical to provide differentiated service across them.

✓ Define differentiated service levels

Define which offers will be made to which customer segments, and determine what those offers will mean in terms of service levels and cost in the OTC processes.

✓ Establish an effective governance model

Determine how to manage the differentiated service levels, and ensure that the strategy is given the management attention it needs.

✓ Build and support effective processes

Ensure tight systems and tools in place. Employees executing OTC process steps need to be able to quickly recognize the customer segment and the business rules that apply in each situation.

4.6 Results

Better integration of order to cash process enables more efficient inventory control, reducing carrying costs and resulting in higher profit.

5 Logistic standard procedure project

Logistic standard procedure aims at providing the training guideline for the new employee in process engineering department. The task for me in this project is to address several aspects of logistics aspects that might be optimized. The list of optimization subject is not supposed to be exhaustive and only aims at providing some support for the most common and relevant aspects of logistics. The first point that can be improved in projects concerns the optimization

of the transport (type of transport, packaging, etc...), an interesting addition to this might involve the creation of a Geomap (on many levels: warehouse, material flows, etc...). The second main type of project concerns the storage process and the automation of diverse tasks. A third aspect that may be optimized concerns the processes for the logistics (importation procedures, INCO terms, organization, documentation, etc...). The IT systems might as well be taken into account while trying to improve our logistics processes by offering some simplification of tasks (e.g.: by using some capacities from SAP such as MRP). Last but not least some new aspects are appearing in the evaluation of supply chains such as “Green logistics” (reduction of environmental impact / carbon footprint) and may represent new challenges.

5.1 Motivation of logistic process project

A common motivation in logistics is of course the minimisation of resource use for the different processes.

“To ensure the long-term success of a company, a continuous controlling of the performance and competitiveness as well as the economic efficiency of logistics is essential. Successful companies therefore periodically analyse their business and adapt their structures in context of a continuous process optimization in order to react to changes in the business environment in a flexible manner. A fully internalized customer orientation with lean and efficient business processes is indispensable for this.”¹

There are extremely varied aspects to a project concerning the optimization of the logistics processes. It is therefore extremely difficult to find a major reason for conducting this kind of optimization as it is extremely dependant on the aspect being improved.

Below is a survey from the website techjournal.org underlining the crucial importance of logistics processes in meeting customer demands:

¹ [Prozess Optimization and Continuous Process Management, 2013], Fraunhofer IML

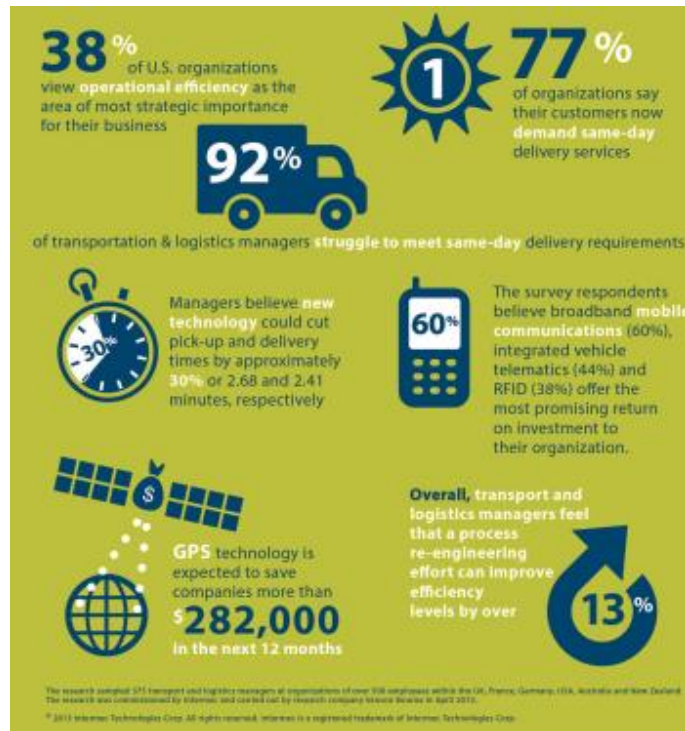


Figure 8 Survey of crucial importance of logistics processes in meeting customer demands

Based on Evonik experience the process improvement/ re-engineering is the biggest lever and provides mostly more than 13% efficiency. Below is a chart represent the potential savings of logistic process's in an EVA tree.

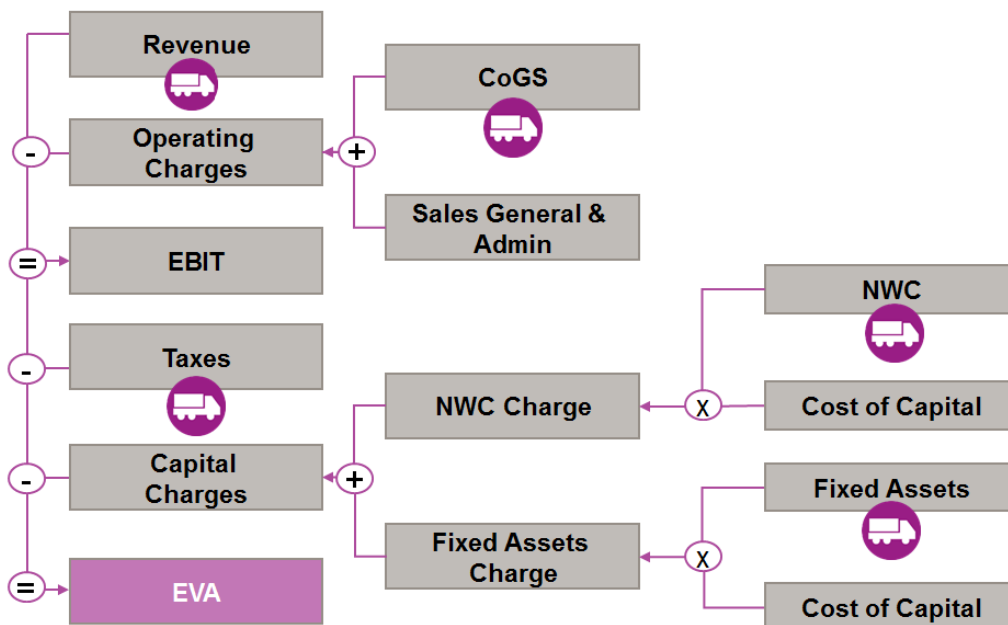


Figure 9 Potential savings in EVA tree of logistic process

After collect the request from the customer (BU, BL), the team leader decide the topic that we want to conduct the further analysis:

Optimisation of transport:

- ✓ available types of transport
- ✓ cost & time
- ✓ route determination
- ✓ packaging
- ✓ INCO term
- ✓ customers mapping
- ✓ expected delivery times

Optimisation of storage process:

- ✓ stock level / utilization / density
- ✓ push/ pull model
- ✓ mapping of storage location(s)
- ✓ workflow of current process

Optimisation of IT order process (SAP):

- ✓ workflow of current order process
- ✓ wave vs. order picking
- ✓ BoM and replenishment times
- ✓ production strategy and segmentation

Optimisation of custom processes:

- ✓ location of clients and suppliers
- ✓ BoM and replenishment times
- ✓ sales quantity and pricing of products

In order to collect further and more detailed information, I was supported with the team and planned interviews with the key positions (Supply Chain/warehouse managers, sales, marketing, procurement, etc...). Interviews are especially strongly advised to define a workflow to optimise a specific process. Such interviews help me collect valuable information as well as a broad overview of the mind-set within the organisation. The optimum is to be two interviewers in order to reduce subjectivity while documenting the interview. It also helped me with identifying potential (source of) conflicts between different services/functions/sites and gathering ideas of potential areas for improvement.

5.2 Optimization of transport or storage process

The operation of transportation determines the efficiency of moving your products. Technical and management progress may improve the moving load, delivery speed, service quality, operation costs, usage of facilities and energy consumption. The role that transportation plays in logistics system is more complex than just carrying goods. With well-handed transport systems the goods can be sent to the right place at right time in order to satisfy customers’ demands. A good transport system performing in logistics activities brings benefits not only to service quality but also to company competitiveness.

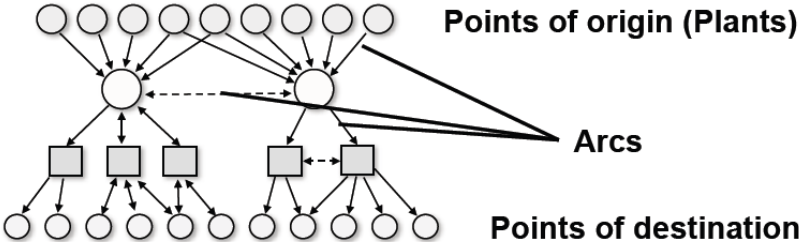


Figure 10 Graphic representation of a transportation network

Logistics enable the industries to optimize their production and distribution processes based on the same resources and promotes the efficiency and competitiveness of enterprises. Transportation represent typically a third of logistics costs. Transportation of your goods is required for the whole life cycle of your products, from their manufacturing until their

delivery to the final consumers and their disposal or recycling. Without well-developed transportation systems, logistics could not bring its advantages into full play, that is to say a reduction in operation costs and duration as well as an improved service quality.

Logistics Cost as a Percent of Sales

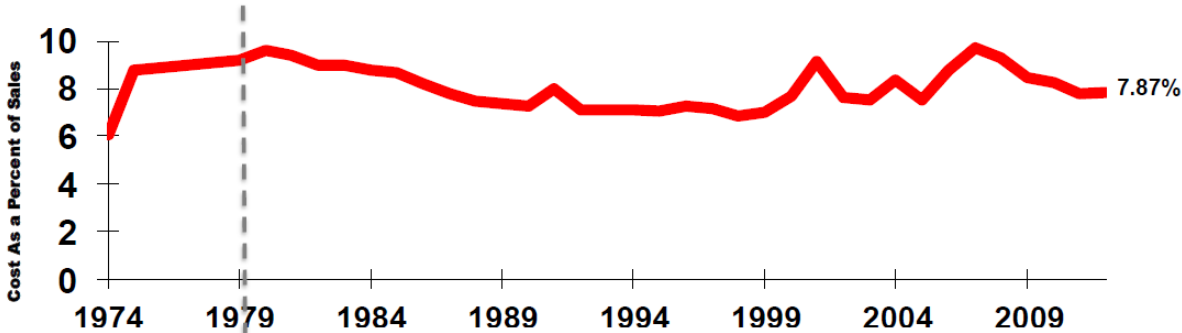


Figure 11 Average logistics cost in the industry as a potential Benchmark, source: Establish: logistic costs and service 2012

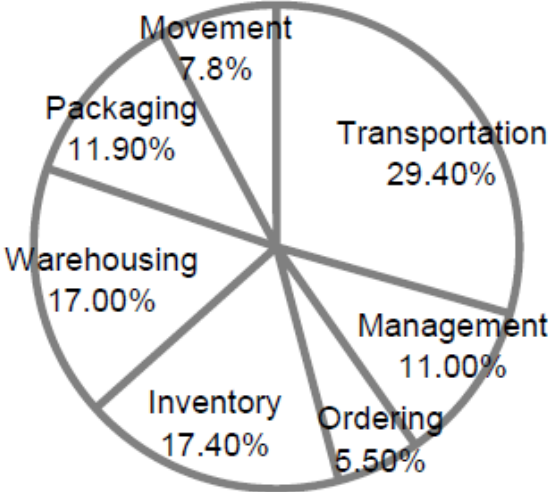


Figure 12 Cost ratio of logistic item, source: The role of transportation in logistic chain

Logistics systems have a growing importance in our SC activities. Since transportation represents the highest cost ratio among the related SC costs [see “cost ratio of logistic item”], the improvement of our transport efficiency is a perfect lever to impact our costs. As we have seen in this part it is not only relevant to switch transportation systems, but a combination might prove to be even more efficient. Another critical point concerns the route followed by your goods, depending on it you will have access to different modes of transport and suppliers thus enabling you to modulate the price and quality of service. Last but not least, the service

provider has of course a rather big influence on the performance (reliability, cost, etc...) of a given transportation system.

5.2.1 Storage in logistic management

If we except inventory (which should be optimized separately, cf. “inventory optimization”), the second highest cost in our “cost ratio of logistic item” is represented by the warehousing with 17%.

A first method to reduce those costs or to improve the quality of your service might be to look at different external opportunities for the storage in a Make or Buy project.

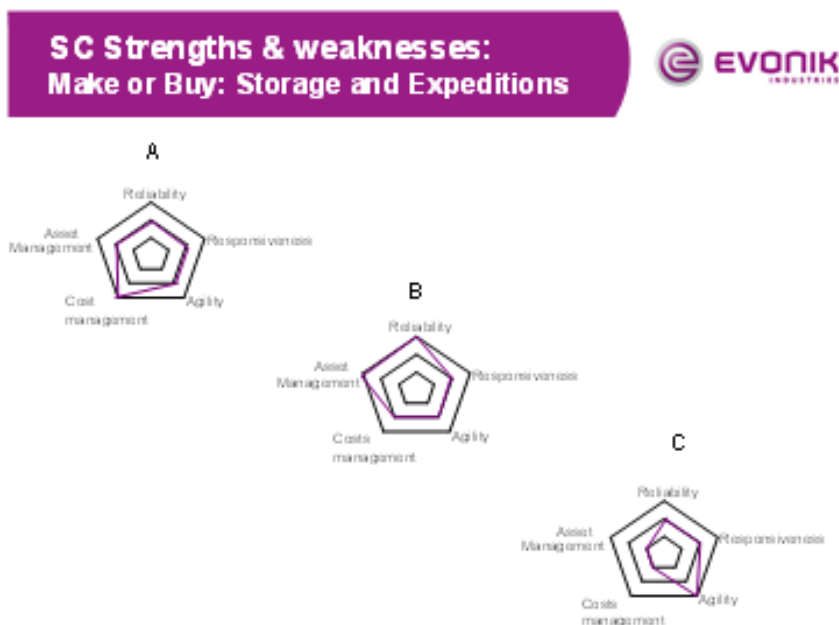


Figure 13 Example of a Make or Buy result

There is also of course the opportunity to improve storage by achieving a higher degree of automation (e.g.: bar coding – scanner) or / and a better space / movements organization (lean, optimized materials flows, etc...).

Barcode and RFID tags are used in many industries. An RFID tag attached to an automobile during production can be used to track its progress through the assembly line.

Pharmaceuticals can be tracked through warehouses allowing goods to be located 24 hours a day and to be quickly found in emergencies.”²

The chemical industry has however already mostly implemented barcode-based solutions which play a similar role as RFID systems. Chemical products are being transported in large packing units do only require a global item-level, the substitution of RFID for the barcode infrastructure on economic grounds could occur over the long term, in the course of regular asset replacement.

5.2.2 Incoterms and custom release

Inward Processing Relief (IPR) and Outward Process (OP) are methods to obtain relief from EU custom duties and VAT charges (IPR only) for some products. Products being exported and then re-imported, as well as products imported and then processed and exported outside of the EU.

Such a project is usually a joint effort between BU, Procurement and custom’s responsible.

As more and more sourcing is taking place in LCC (Low Cost Countries), importing is considered as a core operation. Since the market remains volatile, customers are now seeking to not only buy at the lowest price but to import goods in the most efficient manner. Sourcing products from countries offering the cheapest unit price is no longer the key focus, a stronger emphasis now placed upon improving the holistic performance of import models

According the report from Roland Berger³, in which they conducted interview and got market insights from more than 50 senior-level managers. The interviews indicated that retailers are placing more emphasis on driving down the Total Cost of Ownership (TCO) of their imports.

³ Wikipedia : http://en.wikipedia.org/wiki/Radio-frequency_identification
Optimizing import models-retailers race to total cost of ownership, August 2013

Traditionally, retailers applied a default Incoterm to a given sourcing region. Suppliers based in Europe were typically on EXW whilst suppliers based in China were generally on FOB. They rarely challenged the default Incoterms applied within a region, and had a very passive or even non-existent management of their supplier base from an Incoterm perspective. This situation appears to be changing. 29% of the interviewed retailers are at present considering several Incoterms for a given supplier, and selecting the most effective solution based on forecast TCO and the impact changing Incoterms might have. This leads to the systematic application of the most cost efficient Incoterm option per supplier. It also gives the retailer more control on the overall design of its supply chain network, deciding whether it would prefer EXW, FOB, or FCA.

In Europe, a developed infrastructure and a geographically disparate sourcing network has led to retailers asking some suppliers to provide direct deliveries of orders to DCs and stores by switching to DDP/DDU Incoterms. The main benefits of this lie in inbound logistics cost savings and reduced supply chain complexity.

INCOTERMS® 2012 QUICK REFERENCE GUIDE

Rules for any mode or modes of Transport

SERVICES	EXW	FCA	CPT	CIP	DAT	DAP	DDP	Rules for Sea and Inland Waterway Transport			
	Ex Works	Free Carrier	Carriage Paid To	Carriage & Insurance Paid To	Delivered at Terminal	Delivered at Place	Delivery Duty Paid	Free Alongside Ship	Free on Board	Cost & Freight	Cost, Insurance & Freight
	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays	Who Pays
Export Packing	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Marking & Labeling	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Wrap and Brace	1	1	1	1	1	1	1	1	1	1	1
Export Clearance (Licenses, EEVAES)	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Freight Forwarder Documentation Fees	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Seller	Seller
Inland Freight to Main Carrier	Buyer	2	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Origin Terminal Charges	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Buyer	Seller	Seller	Seller
Vessel Loading Charges	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Buyer	Seller	Seller	Seller
Ocean Freight / Air Freight	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Seller	Seller
Nominate Export Forwarder	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Seller	Seller
Marine Insurance	3	3	3	Seller	3	3	3	3	3	3	Seller
Unload Main Carrier Charges	Buyer	Buyer	4	4	Seller	Seller	Seller	Buyer	Buyer	4	4
Destination Terminal Charges	Buyer	Buyer	4	4	4	Seller	Seller	Buyer	Buyer	4	4
Nominate On-Carrier	Buyer	Buyer	5	5	5	Seller	Seller	Buyer	Buyer	Buyer	Buyer
Customs Broker Clearance Fees	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Buyer	Buyer	Buyer	Buyer
Duty, Customs Fees, Taxes	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Buyer	Buyer	Buyer	Buyer
Delivery to Buyer Destination	Buyer	Buyer	5	5	5	5	Seller	Buyer	Buyer	Buyer	Buyer
Delivering Carrier Unloading	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer

Notes

- Incoterms® do not deal with the parties' obligations for storage within a container and therefore, where relevant, the parties should deal with this in the sales contract.
- FCA Seller's facility - Buyer pays inland freight; other FCA qualifiers, Seller arranges and loads pre-carriage carrier and pays inland freight to the "T" delivery place.
- Incoterms® do not obligate the buyer nor must the seller to insure the goods, therefore this issue is addressed elsewhere in the sales contract.
- Charges paid by Buyer or Seller depending on Contract of Carriage.
- Charges paid by Seller if through Bill of Lading or door to door rate to Buyer's Destination.

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Figure 14 INCOTERMS 2012 quick reference guide

Some other retailers are switching to EXW or FCA INCO terms with a few suppliers. Retailers can then take ownership of transporting goods from the supplier's facilities or another named location to the port of export. The SU-LO at Evonik Industries AG advises the use of the FCA INCO term which means that the loading security is Evonik Industries AG's responsibility.

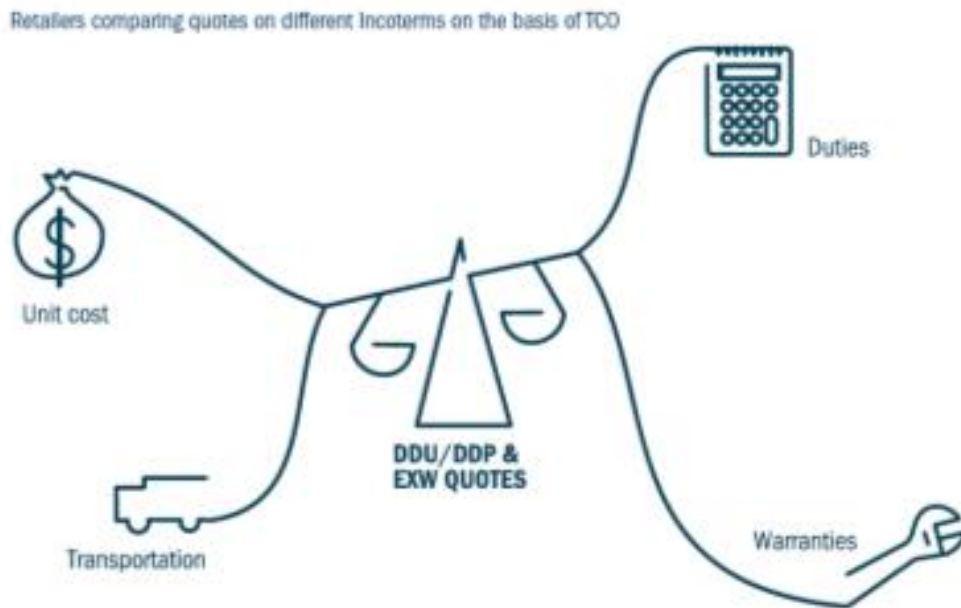


Figure 15 Retailers comparing quotes on different INCOTERMS on the basis of TCO

5.3 Define strategy & roadmap (solution) for future savings

This was decided to be part of the workshop or planned with the project team.

Here are some strategies/actions that may be implemented in order to optimise the logistics processes:

- Using optimum Incoterms (possible drawbacks on NWC)
- Modify type of transport
- Consolidate your transports
- Using a new kind of packaging
- Implementation of a bar coding / RFID system

- Scoreboard with KPIs to track performance
- Implementation of a MRP system (SAP)
- Use of custom release possibilities

6 Overview of methods/tools

Work package	General	Supply Chain	Six Sigma
Define likely scope & target			<ul style="list-style-type: none"> • VOC (Voice of the customer) • SIPOC (Supplier-Input-Process-Output-Customer)
Set up project sponsoring and team		<ul style="list-style-type: none"> • Project documentation 	
Collect background information & Conduct interviews	<ul style="list-style-type: none"> • SAP 	<ul style="list-style-type: none"> • SC training logistic processes • Data query (template) 	
Estimate potential (business case)			<ul style="list-style-type: none"> • CTQ (Critical To Quality) • SWOT analysis (Strengths Weaknesses Opportunities Threats)

Definition of project's KPIs			<ul style="list-style-type: none"> • CTQ (Critical To Quality)
Segment business in relevant fields	<ul style="list-style-type: none"> • Pareto principle 	<ul style="list-style-type: none"> • SC training segmentation & service level + standard procedure 	

Work package	General	Supply Chain	Six Sigma
Conduct sensitivity & risk analyses	<ul style="list-style-type: none"> • FMEA (Failure Mode & Effect Analysis) 		
Confirm analyses results	<ul style="list-style-type: none"> • Workshops • 4 eyes principle 		
Establish transparent KPIs		<ul style="list-style-type: none"> • SC training Performance Management & standard procedure 	

Complete project		<ul style="list-style-type: none"> • Project End Report 	
Confirm implementation of new processes & confirm savings	<ul style="list-style-type: none"> • Workshop 	<ul style="list-style-type: none"> • Project End Report • Potential Monitoring System 	

One of the possibility to validate previous analysis and to involve the management and the team as efficiently as possibly is to plan some workshops (probably one workshop per segment) in order to discuss the results together.

Those workshops would have to be prepared really carefully with your core team as they are some essential aspects of the projects in which the deciding parts will have to recognise the results of your analysis and confirm the potential that should be achieved thanks to this project. For the preparation of such milestones it is strongly recommended to have someone reviewing your work to make sure there are no mistakes left (4 eyes principle).

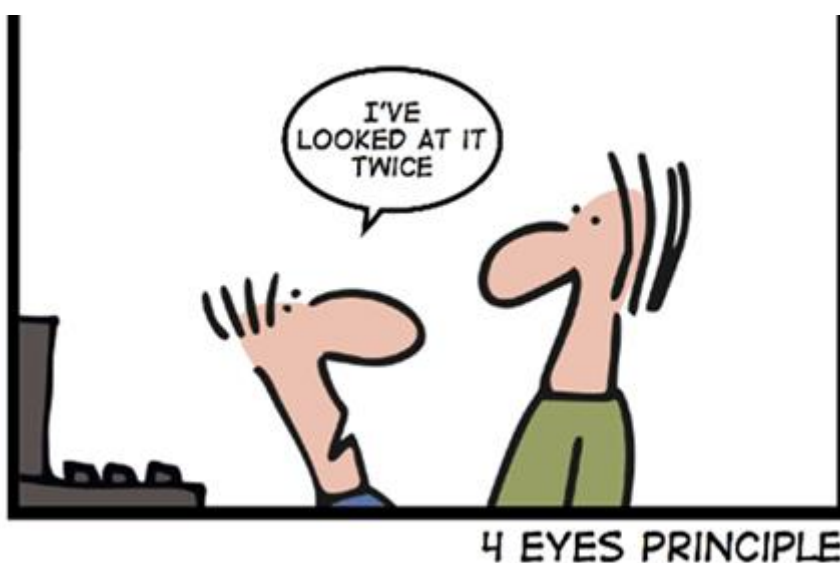


Figure 16 4 EYES PRINCIPLE

Make sure that you address all of the main points, so that there will be no further questioning later on and those starting hypotheses are clearly documented. Transparency should be a keyword for the presentation of your results.

7 Hidden cost in supply chain

In the last phases of the internship in Evonik, my main task is to develop a topic proposal regarding the hidden cost of supply chain between the trade of China and European. Here I will introduce how I develop the topic and what result I got.

China became the trading and outsourcing target country in 90s due to the following reasons:

- High-growth country with great potential to generate huge demand for goods and services
- Availability of low-wage Chinese workers

But after decades, this seems not to be the true, lots of companies ask: is it really a winning, can't – miss strategy to trade and outsourcing in China?

There are some factors have been overlooked:

- Oil prices keep going up, making cargo-ship fuel much more expensive
- Wages in China are now more than 7 times what they were in 2004(10 year gap). And are rising at annualized rate of about 15%
- Much of the illusive labor savings in low-cost countries is trumped by the hidden waste and overhead costs required to make the overall supply chain function well.

The proposal is to provide an idea of where the hidden cost can be found, and the area should be take consider the Evonik business unit in Shanghai. And listed areas are:

- Velocity
- Quality
- Cost
- Resource
- Waste
- Customer experience

Within these areas, the top hidden cost is defined:

1. Cost of management and coordination of contractors. (cost of employees' time and travel expense incurred when visit abroad site or supplier. Missed market opportunities, loss of customer confidence, weak local leadership, bad supplier selection)
2. Cost of inventory performance.(manufacture in China have the possibility reduce flexibility in design as well as the ability to respond to schedule changes, this usually translate into more inventory in the global pipeline. More mismatch between supply and demand, more shrinkage from variances.)
3. Cost of unplanned logistics activities and premium freight(trading between China and EU always has the difficulty problem of responding to changing customer requirements, further more, it increases the distance and the number of touch points between order entry and order fulfillment , when many “hands” are involved, the right products in the right mix and volumes may not be in the right places at the right time.).
4. Cost of inappropriate sales and operational planning (S&OP).(complexity of risks and cost may failed managed in the multiple demands streams among the huge network.)

5. Cost of poor or substandard quality. (quality control have always been a tough topic while dealing with Chinese manufacturers, and the cost behind the bad quality product can represent big portion of the revenues)
6. Cost of supplier management (cost associated with selecting, developing and maintaining a supplier and ensuring that it meets expected performance levels in areas such as process capability, quality and reliability, capacity, flexibility in regard to changes, turnover and retraining.)
7. Cost of cash flow (Chinese currency appear to be an important factor which influence cash-to-order cycle)
8. Cost of unplanned and unforeseen risks. (EU company tended to overvalue the labor savings they expect to gain from trading in China and undervalue all the other potential costs and risks. The risk of unauthorized copying of products increases when China manufacturing in involved)

The initial suggestion is to redefine and employ a combination of seasoned experience with the best data-driven and evidence-base strategies in today's global market place. Some of the effective tools include cost analysis and using an organization's integrated enterprise architecture and other information technology resources to trace transaction stream and reconstruct these hidden costs.

8 Conclusion

Main Achievements

- Helped the company to map the processes of inventory optimization, order to cash and logistic issue, analyze problems comparing the current situation with the industry competitors, and provide improvement suggestions.
- Assist the team to collect data, analyze the problems, providing possible solutions, expected results.

In conclusion, this project is very useful for me, not only in the content itself but also in the way in which I was doing it.

As I only had rarely working experience in supply chain and logistic topic, I highly appreciated this opportunity from the beginning. At first I met with a lot of different problems when I tried to adapt myself to the German working environment, so the first thing I want to mention is that this internship improve my ability to adapt to new environment, new enterprise culture and new language environment. I tried my best to make myself as a professional hard work clerk instead of a student which just came out from the university. Of course, after these 7 months I increase my German language and can have better communications with other staffs.

The second thing I want to mention is that this work made me consider more about the future work, my future career path. I understand better what I want to do or we say what I intend to make as my job in future life. I found my interest and good capability still stays in the Logistic and supply chain sector, and I also prefer a job relative with this issue in the future.

Then I increased my working efficiency after this internship. Now I know how important punctuality is in an organization like Evonik. Everyone has their work flow and you cannot let others wait your task. The fruity of the work in the organization is very important.

Also, I noticed some differences between theories and practices which is always mentioned by people who are already working. Something easy in the theory may not be the same thing

in the reality; some reasonable obvious thing may cost you a whole day to figure out why this is right, why I should do in this way. The most important things I picked up in Evonik are:

- Work with priority
- Work with logic
- Work with input and output

9 Bibliography

- [1] April, J. 2003. Practical Introduction to Simulation Optimization, Proceedings of the 2003 Winter Simulation Conference, 71-78.
- [2] Arslan, H., S. C. Graves and T. Roemer. 2005. A Single-Product Inventory Model for Multiple Demand Classes. Working Paper, MIT.
- [3] Graves, S. and S. P. Willems. 2000. Optimizing Strategic Safety Stock Placement in Supply Chains, *Manufacturing & Service Operations Management*, 2(1), 68-83.
- [4] Jung, J. Y., G. Blau, J. F. Pekny, G. V. Reklaitis and D. Eversdyk. 2004. A Simulation based Optimization Approach to Supply Chain Management under Demand Uncertainty, *Computers and Chemical Engineering*, 28, 2087-2106.
- [5] Nagurney, A., J. Cruz, J. Dong and D. Zhang. 2005. Supply Chain Networks, Electronic Commerce, and Supply Side and Demand Side Risk, *European Journal of Operational Research*, 164, 120-142.
- [6] Stadtler, H. and C. Kilger. 2005. Supply Chain Management and Advanced Planning: Concepts, Models, Software and Case Studies.
- [7] Cakanyidirim, M. and S. Luo. 2005. (R, Q) Policy with Lead Time Options, Available At http://som.utdallas.edu/faculty/working_papers/SOM200538.pdf.
- [8] Ettl, M., G. E., Feigin, G. Y. Lin and D. D. Yao. 2000. A Supply Chain Network Model with Base-stock Control and Service Requirements, *Operation Research*, 48(2), 216-232.
- [9] Rao, U., A. Scheller-Wolf and S. Tayur. 2000. Development of a Rapid-Response Supply Chain at Caterpillar, *Operations Research*, 48(2), 189-204.