

KEMI-TORNIO UNIVERSITY OF APPLIED SCIENCES

Effective information flow through efficient supply chain management - Value stream mapping approach Case Outokumpu Tornio Works

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ABSTRACT

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The general aim of this thesis is to explore effective information flow through efficient supply chain management by following one of the lean management principles, value stream mapping. The specific research questions are the following: How efficient is Outokumpu Tornio Works` supply chain collaboration at this moment? Which non-value added activities impact on information flow within the supply chain of Outokumpu Tornio Works`? How are non-value added activities transplanted to value creation to gain competitive advantage?

A qualitative research method and single case study method are used in this thesis. Data collection was carried out by using multiple sources: semi-structured interviews, participatory observation, the researcher`s own experience on the field and internal documents which are in use in the case company. Since the nature of this research is confidential, the Case company, Empirical findings, Discussions and Conclusions are not published in their full length in the Library database.

To conclude, it can be suggested that effective information flow within supply chain functions is achieved through functional supply chain collaboration as well as fluent information sharing within supply chain functions. Especially through cross functional collaboration the case company can effectively eliminate wastes and increase value added activities towards a more integrated supply chain.

Keywords: Supply chain management, effective supply chain collaboration, information flow, cross functional collaboration, lean management, value stream mapping

ABBREVIATIONS

SCM	Supply Chain Management
VSM	Value Stream Mapping
MDF	Master Distributor Flow
DCB	Decoupling Buffer
HIKU	Hienokuormitusjärjestelmä (Production planning information system)
MTS	MyyntiTuotantojärjestelmä (SalesProduction information system)
MTS2000	Valmistuksen suunnittelujärjestelmä (ProductionPlanning information system)
QMATO	Tuotannon ohjausjärjestelmä (Production information system)
PIHA	Pinnanlaadun hallintajärjestelmä (Surface information system)
RETU	Tuotannon ohjausjärjestelmä (Production information system)
FOCUS	SAP – Order information system
I2	Logistic information system
G&SM	Group Sales and Marketing

FIGURES

Figure 1. Information flow through order – delivery –process

Figure 2. Information flow through M6 (Kloster and OSTP)

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1 INTRODUCTION

This chapter is an introduction to the background of this thesis. In addition, the key terms as well as research objectives and research questions are presented in this chapter. At the end of the chapter the structure of this thesis is introduced.

1.1 Orientation

The competition in today's business is challenging. The focus on increasing competitiveness of companies is aimed at developing their own core competencies such as supply chains for achieve more stable state on markets and better customer satisfaction. Companies have realized the opportunities in which lean supply chain management allows them to intensify supply chain activity to evaluate non-value added activities and transplant them to value creation through a tightly integrated environment. Competitiveness of companies derives from their ability to produce high-quality products or goods right-in-time to customers. The pioneer of lean management practices is Toyota by its Toyota Production System. The target of applying lean principles in the company's supply chain operations is to increase customer satisfaction through right-in-time deliveries. Value stream mapping (hereinafter VSM) is based on Toyota Production System –model and is created to describe order-delivery process and internal patterns of the case company. Shortly put, this lean thinking principle` aims to determine non-value added activities.

Supply chain management consisting supply chain actions in the case company is seen as a competitive advantage. As the main aim of the research is to research activities which impact on the information flow in the case company's supply chain, it is essential focus on supply chain management and supply chain collaboration perspective. Extensive literature dealing with the research field is available. Ehap and Shaikh (2010, 4) argue that the key to stay competitive and achieve core competency in today's business is through effective supply chain management (hereinafter SCM). Hugos (2011, 2) introduces real-time supply chains which are delivering a new level of operating efficiency and responsiveness to the markets and customers. Ehap and Shaikh (2010, 4) point out the strategy of applying SCM will not only impact on a

companies' market positioning but also strategic decision for choosing the right partners, resources and manpower. To create a niche for competitive advantage a company must see the whole picture of the processes and find a way to know which process can be reduced, eliminated, created and developed. Skjott-Larsen and Schary (2007, 5) argue that supply chain management is not only managing the flow of material but managing the flow of information.

Information sharing plays enormous role as a part of information flow, since it can be seen either unifying or disjunctive factor in supply chain. The importance of information sharing in a supply chain has been recognized in scientific circles. However, there is still only scarce research concerning this essential topic. Chibba and Rundquist (2009) define information sharing as an important factor for effectiveness within the internal supply chain. Their study showed the importance of integrated information systems, but also an impact of collaborative culture and an awareness of the human-technology interface. The objective of this thesis is to identify and evaluate activities that could improve information flow and enhance the flow of the case company's supply chain.

1.2 Background

Since business environment has changed into an increasingly challenging direction, it is argued that being the best at producing or selling a superior product is not enough. In today's economy, the battlefield is shifting from individual company performance to supply chain performance (Hausman 2003, 62). In other words, competition has transformed from company versus company to supply chain versus supply chain. Winners in this competition are the ones who continuously lead supply chain to a leaner direction by managing production processes through effective information exchange efficiently and constantly developing supply chain collaboration in the way it increases right-in-time deliveries as well as customer satisfaction in overall. Outokumpu Tornio Works have realized the possibilities that lean supply chain provides to stay competitive in markets and improve internal measures such as inventory levels and delivery accuracy.

In this thesis the aim is to evaluate non-value added activities influencing to information flow within the case company's supply chain. In addition, to transplant non-value added activities to value creation. As a result of this thesis, value stream maps were created to the case company. In the year 2010 the similar value stream mapping was made concerning production. It showed problems in different stages of the production and helped in planning patterns to achieve improved quality and efficiency in production (Liker & Meyer 2006). As the value stream mapping method found to be functional in the purpose of identifying non value-added activities in the production it was decided to be used also by describing the information flow within supply chain of the case company. This research is executed through interviews, internal documents, observations and meetings with the production engineer and the manager of development in the autumn 2010.

In the case company the supply chain consists of three different functions, i.e. the Production planning, the Logistics services and the Commercial departments. Collaboration between these functions takes place in day-to-day work and the main idea is simple; high-quality products right-on-time to the customer. This research sets out to detect the difficulties in order to suggest solutions for achieving increasingly efficient information flow and through that achieve competitive advantage. It is worth noticing that when creating knowledge of activities influencing to information flow within supply chain of the case company such matters as supply chain collaboration and importance of cross functional collaboration are added as they both are tightly linked to information flow within each function of supply chain.

First it is necessary to point out the differentiation of areas in which each function is divided. In the Commercial and the Logistics services departments there exists geographical allocation. The Production planning department's allocation between internal teams is based on different steel grades. Previously the possibility to use geographical allocation in the Production planning function was investigated but it showed out to be problematic. Steel grades would have been dispersed too widely among employees and the quality of work would have suffered significantly. Other

differentiation is the team work which is used both in the Logistics services and in the Production planning departments but not in the Commercial department.

I work in the Production planning department as a planner and I am in the center of supply chain processes. Many problems concerning information flow arises the perspective of the Production planning are usually common within the whole supply chain. Still an objective review through the supply chain as a driven force of efficient information flow needs to be conducted to understand the whole processes.

1.3 Key terms

The key terms of the study will be presented in this chapter. The thesis is built strongly around the five key terms discussed in Table 1.

Table 1. Key terms

Supply chain management	involves planning, designing and controlling of the flow of material, information and finance along the supply chain in order to deliver superior value to the end customer in an effective and efficient manner (Shah 2009, 161).
Effective supply chain collaboration	is working together toward mutual objectives through the sharing of ideas, information, knowledge, risks and rewards (Cohen & Russel 2005, 140).
Information flow within supply chain	means the exchange of information between the different stages of a supply chain (Skjott-Larsen & Schary 2007, 104).
Lean thinking in supply chain management	is the use of lean principles to align activities across corporate functions within the firm and manage business relationships with customers and suppliers (Lambert 2008, 217).
Value stream mapping	value stream mapping is a tool used to visually indicate all actions required to bring a product or service in logical steps from start to finish (Gopalakrishnan 2010, 95).

1.4 Research objectives and questions

The main objective of this thesis is to research how the information flow within supply chain of Outokumpu Tornio Works could be improved to increase value creation. The physical material flow is highly dependent on the information flow that influences to performance measures set to the case company. These performance measures are inventory levels and the delivery accuracy which determinate the whole performance of the case company.

Drawing from the objectives of this research, the following research questions are addressed in this work:

1. How efficient is Outokumpu Tornio Works` supply chain collaboration at this moment?
2. Which non-value added activities impact on information flow within the supply chain of Outokumpu Tornio Works`?
3. How are non-value added activities transplanted to value creation to gain competitive advantage?

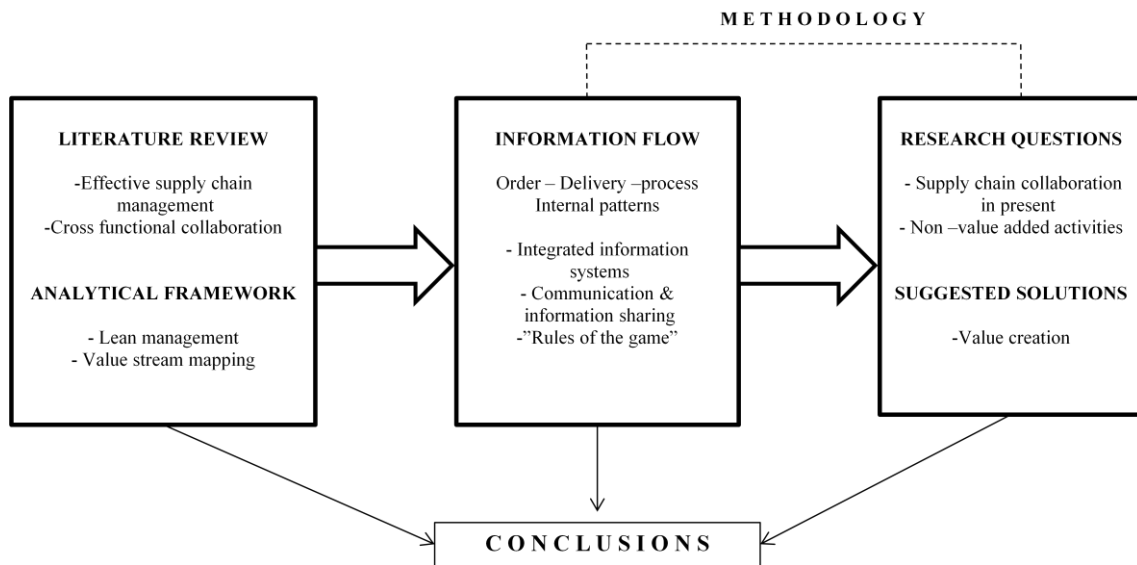
The answer to the first question is to point out the current state of supply chain collaboration and is based on the Empirical findings. The answers to the second and third questions are essential for evaluating non-value added activities as well as possible solutions to transplant them to value creation. These three questions are answered through the information collected from the specialist interviews at the Commercial department, the Production planning department and the Logistics services department. Additionally, information was received through weekly monitoring meetings with the production planning engineer and the supply chain development manager in the autumn 2010. Value stream mapping is created based on previous sources.

1.5 Scope of the thesis

In this thesis the aim is to evaluate non-value added activities influencing to information flow within the case company's supply chain. In addition, to transplant found non-value added activities to value creation. The main concepts concerning this research are defined in the key term chapter. The research is build strongly around the key terms with value creation concept. Production is not included in this research. However, the material flow was essential to take within value stream maps, since the flow of material is triggered by on associated information movement and the supply chain management is the oversight of materials, information and finances and integrating these flows within the case company.

1.6 Structure of the study

In chapter 2 Literature review is presented in order to construct the theoretical framework for this thesis. The Analytical framework of lean management –concept including value stream mapping –approach is introduced in chapter 3. The Research methodology in chapter 4 presents the qualitative approach and the case study method with techniques used to execute the research. Additionally, data collection and analysis are presented in chapter 4. The case company is introduced with order-delivery process and internal patterns with the current state description in chapter 5. In chapter 6 Empirical findings are presented. Further on in chapter 7 concerning Literature review, Analytical framework and Empirical findings are discussed to give deeper insight of non-value added activities influencing to information flow within supply chain of the case company. Additionally, in chapter 7 Conclusions consisting the summary and suggestion for further research are presented.

Table 2. Structure of the study

2 LITERATURE REVIEW

In this chapter, the focus is to draw the framework of activities which impact to supply chain collaboration as well as role of the information flow when creating efficient supply chain collaboration. Even though the information flow is playing a central role of this thesis it is essential to explain the supply chain actions because they are eventually as starting and ending points of information flow. Additionally, supply chain collaboration influences to the quality and the amount which is highly dependent on such factors as motivation and experience in the supply chain. The main purpose of a value stream mapping is creating value instead of supporting wastes. Therefore the following chapters is constructed around the value creation –concept.

2.1 Supply chain management

In today`s business world the main focus on competition is not only between different companies but also between supply chains. This should be recognized in the case company because the satisfaction of the final customer is extremely important for the successfulness of the whole supply chain. Effective supply chain management of supply chain processes is crucial not only for the case company to survive on competitive markets but increase its competitive advantage through developing its supply chain actions for more efficient direction.

Several definitions for the concept of supply chain are offered in literature. Blanchard (2010, 3) describes it as the sequence of events that cover a product`s entire life cycle, from conception to consumption. When being more specific supply chain involves planning, design and control of flow of material, information and finance along the supply chain in order to deliver superior value to the end customer in an effective and efficient manner (Shah, 161). Creating value through efficient information flow within supply chain is the target which the case company desires to reach by using value stream mapping. Hugos (2011, 2) emphasizes that companies that learn how to build and participate in strong supply chains will have a substantial competitive advantage in their markets.

According to Mentzer (2004, 1), supply chain is a considerable source of competitive advantage in the global marketplace because in highly competitive markets, “the simple pursuit of market share is no longer sufficient to ensure profitability” and, thus, companies focus on redefining their competitive space or profit zone. In deeper level (Fleisher & Bensoussan 2007, 201) argues that “effective supply chain management can translate to competitive advantage if flow of information and products among the supply chain participants are synchronized and all parties` interests are constructively aligned.”

In the case company, at the Group level, effective supply chain management is seen as developing processes and supporting systems that conform to current and future requirement. Every unit under Outokumpu has their own supply chain management organizations which are steered from the Group level. Therefore, it can be stated that supply chain management and its capabilities are recognized in the case company as an enabler to compete in global business. Still it has to be noticed that competition in the markets is challenging which forces the company to develop its supply chain actions constantly for better awareness of customer needs. Commonly the only way to compete on the markets is to focus on the company`s core competences. In this case study by enhancing the supply chain and collaboration within the supply chain functions in the way that effective information flow is achieved. Essential features of effective supply chain management are good collaborative forecasting, planning and realistic replenishment scheduling.

The effectiveness of supply chain management is shown in the case company through created models, internal patterns, which consists of a chosen variety of products. In other words, this means flexible supply and production processes which are quickly responding to the changed demand, a short- cycle, demand-driven order-to-delivery process and accurate relevant information that is available on demand throughout the supply chain. The main aim is to respond quickly to the needs of chosen group of customers, such as retailers, through flexible planning and implementation in the supply chain as well as tight collaboration within the supply chain functions. These internal pattern models will be represented in chapter 5 and discussed based on Empirical findings in chapter 7. The supply chain strategy supports the Group

Commercial strategy through the focus on higher delivery accuracy, stable and shorter lead times. In addition, it supports the Group's overall strategy by optimizing inventories, which results in an efficient use of working capital.

2.2 Creating value through effective supply chain collaboration

It was already recognized earlier that “effective supply chain management can translate to competitive advantage if flow of information and products among the supply chain participants are synchronized and all parties’ interests are constructively aligned” (Fleisher & Bensoussan 2007, 201). The aim of this chapter is to recognize characteristics of the effective supply chain collaboration and benefits it can offer to the company, in the form of competitive advantage. Additionally, cross functional team approach is taken into account by evaluating effectiveness of the supply chain.

The driving force of effective supply chain management is based on collaboration within participants in supply chain. According to Horvath (2001, 206), strategic supply chain management demands collaboration among all participants in the value chain, whatever their size, function, or relative position. Sahay (2003, 76) continues in the same line by defining “the collaboration as an enabler of partners to jointly gain a better understanding of future product demand and implement more realistic programs to satisfy that demand”. In other words, “supply chain collaboration is seen as working together toward mutual objectives through the sharing of ideas, information, knowledge, risks and rewards” (Cohen & Russel 2005, 140). More or less the idea is to create win-to-win situation within supply chains and by that increase the feeling of cohesion through common goals and acting as a one entity. It is notable that through effective supply chain collaboration the company gain benefits, both strategic and financial. These benefits can deliver cost savings and increased revenues or the combination of both. More precisely effective collaboration can accelerate entry into a new market, increase flexibility, and provide access to expertise not available inside the company.

It is important to realize that supply chain management is not a division, department or a section. It is there for not another structural silo to be bolted on to existing

departments of production, procurement, logistics, marketing, finance and so on (Emmet & Crocker 2006, 110). Supply chain management is seen cross functional and the power of collaboration within supply chain lies on how well is common goal set and implemented together. Integrated collaboration through cross functional teams within supply chain has shown to improve the performance of the company. According to Blumenthal (2004) much of work up and down supply chains can only be done by cross functional teams where you have team members from the technical groups, the various engineering disciplines, construction services, project management, procurement, safety, quality, planning and marketing. Additionally, Blumenthal (2004) states cross functional team as the only type of team that can tackle the wide range of problems organizations are facing today. In other words, effective supply chain collaboration is achieved through cross functional teams.

It is essential at this point to clear out definition of cross functional team. According to Heathfield (2011) cross functional team contain groups of people who are pulled together from across departments or job functions to deal with a specific product, issue, customer, problem, or to improve a particular process. Cross functional teams can effectively be used to overcome functional blocks and one-sided view through effective information sharing which is based on every participant's experience on their own area. Lia and Fredericks (2005, 2) defines that cross functional teams are formed for a variety of specific purposes, such as;

- to bring products to market or to profitability more quickly
- to find quick cost-reduction opportunities
- to jumpstart revenue or market-share growth
- to improve the quality of operations and results
- to discover better ways of doing business that will serve the company or customer
- to find revenue, cost, and operational synergies within product lines
- to integrate product lines as a result of a downsizing, reorganization, or merger/acquisition
- to respond the competitors latest move, and

- to prepare more comprehensive and timely business plans and forecasts

As a summary all previous purposes is seen value creation to the company through effective cross functional collaboration.

Even though cross functional collaboration at its best increase the company`s competitive advantage through value creation there exist complexities which are challenges team must overcome to be successful. Lia and Fredericks (2005, 2) determines complexities and challenges as follows;

- competing functional area goals that conflict with the team`s purpose
- team members who are not full time to the team yet are expected to participate fully
- unclear sponsorship and ownership for the team and its goals
- a lack of resources from each functional area represented on the team
- geographic and time zone differences
- compressed time frames to become effective and to deliver result
- few, if any, formal or informal company-wide supporting structures
- no pre-existing team identity to establish credibility and authority

In the case company cross functional teams are used to develop new patterns such as internal pattern models to serve markets more centralized. The purpose of some of these internal pattern models is to create value to the company through distinctly structured cross functional team with clearly shared responsibilities and goal, increasing delivery reliability for better customer satisfaction. It is essential to understand expectations of the customer and responding to these expectations by developing this efficient internal pattern. Eventually the customer orientation should be followed through the whole supply chain. According to Blumenthal (2004) the solution to meeting expectations typically is a high performance cross functional team where team works with suppliers` cross functional team to ensure that expectations, requirements, technical specifications, delivery schedules, and other related matters are clearly understood.

2.3 Managing information flow within supply chain

Information flow presents an enormous role in effective supply chain collaboration. Since it support the physical material flow. Necessity to share information across the various entities along the supply chain is definitely of paramount importance (O Solis, 2001, 2). According to Kulkarni and Sharma (2004, 252) information serves as the connection between the supply chain`s various stages, allowing them to coordinate their actions and bring about many of the benefits of maximizing total supply chain profitability. The company has to realize the value which effective information sharing as a form of information flow can offer. In the perspective of supply chain management the effective information flow is tightly connected to the movement of material and money flows.

Inventory levels as well as delivery accuracy are the determined activities which influences in the company`s whole performance and are the main measures in the case company. In other words it is essential to share information fluently and quickly concerning such issues as changes in the demand or production so that remedial operation can put to action promptly. However, the structure of supply chain are seen simple the needed information to make quick actions is often missing which can increase inventories and by that decrease the company`s performance.

According to Chibba and Rundqvist (2011) the information flow can be divided into two separate approaches; first, the information needed to produce the actual product or service. This information is directly connected to the physical material flow i.e. order-, delivery- and quantity information. Approach of direct information flow is seen in every day working environment through transactions between the information and the physical material flow. For instance whenever a customer changes quantity of order it is transferred direct on the physical material mainly through information systems. Secondly, there exists indirect information flow approach presenting the information flow about the customer, future markets, future changes or future customers. This information approach is executed from the manager level and are closely connected to the case company`s strategy.

As on information sharer the management level is playing a center part. The information which influences the operational levels day-to-day work has to be shared fluently from managers. It is important that all the information concerning a certain supply chain function is achieving the same information at the same time and have the same ability to a common information data. This is essential when building common collaborative culture and strengthen feeling of the supply chain as a one entity.

Literature concerning information flow is tightly connected to the supply chain collaboration. Shiu Kong Lau (2007, 3) emphasizes collaboration is a pattern of decision making and communication among a set of actors who perform tasks to achieve goals. The goals can be minimization of operating costs and inventory levels of enterprises in the supply chain (Shiu Kong Lau 2007, 3). Especially it has to be noticed that the only way to achieve efficient collaboration is through constricted information sharing between supply chain functions. The implications of abundance of available information are enormous. It should be apparent that having accurate information about inventory levels, orders, production, and delivery status throughout the supply chain should not make the managers of a supply chain less effective than if this information were not available (Simchi-Levi, Kaminsky & Simchi-Levi 2003, 101).

2.3.1 Bullwhip effect

Mahadevan (2010, 290) defines the bullwhip effect as a manifestation of the increasing severity of distortions in demand information and ordering patterns as the information travels from one layer of the supply chain to next layer. When ordering patterns differ across each layer the bullwhip effect gain strength and problem get complicated. While distributors estimate lesser demand and place orders for fewer quantities, they may receive larger orders from retailers which will cause further problems in supply chain each layer (Mahadevan 2010, 290). Finally it leads to situation where ordering pattern is not representative of the reality and is shown as increasing inventories in every level of the chain, inadequate or over capacity and problems in availability of products (Mahadevan 2010, 291). The bullwhip effect can

be reduced by encouraging supply chain partners to share sales, capacity and inventory data with each other.

2.3.2 Role of information systems within supply chain

One and the most important role of information system in the supply chain are to bind the entire chain together as a single integrated unit. The use of supporting information technology is necessary for effective supply chain operations. In other words, this means that information technology should support internal operations and also collaboration between companies in a supply chain (Hugos 2011, 109). However, there exist also challenges with information technologies. Problems through different systems can cause slowness of transaction information which has to be eliminated as soon as possible. In the long run this kind of barriers impact negatively on the day-to-day work since nowadays information systems is commonly used as working tools in the companies.

According to Skjott-Larsen and Schary (2007, 105) the basic requirement for optimizing the total supply chain is to integrate information processing involving all supply chain actors. In the case company this is seen independent information systems in the Commercial-, in the Production planning- and in the Logistics department as well as in the Production departments. These information systems are linked together. It means that when there occur disorders in information systems it slows day-to-day working significantly. All operations within the supply chain are activated by a series of transactions, information flow, that trigger the movement of products and materials. As it was recognized earlier the main factor of how fluently is the information flowing within the supply chain depends on how effective is supply chain collaboration. Even though there are also seen disorders which are not caused by people but the information systems used in the company.

3 ANALYTICAL FRAMEWORK

The research in this thesis pursues to increase effectiveness of information flow within supply chain in the case company through efficient supply chain management. Effectiveness of information flow is evaluated by using the value stream mapping tool which purpose is to identify non-value added activities and suggest improvements to transplant non-value added activities to value creation. However, a value stream mapping is a visualization tool based on the lean thinking principles. The information concerning a value stream mapping is implemented through interviews, observations and already existing data in terms of value stream mapping tool. The essential information within the Literature review of this thesis has taken into account while structuring the Analytical framework.

The Analytical framework contains phases of lean thinking as a foundation of lean supply chain approach. In addition, the concept of value and waste is explained since their central role when using a value stream mapping approach towards a leaner supply chain. Finally, there will be presented value stream mapping approach and performance measurement used in this thesis.

3.1 Lean thinking in supply chain management

First of all, it is essential to clarify the relationship between the lean thinking, as a main philosophy of the lean management, and the supply chain management. According to Lambert (2008, 217) “lean thinking in the supply chain management is the use of lean principles to align activities across corporate functions within the firm and to manage business relationships with customers and suppliers”. The target of applying lean principles in the case company’s supply chain operations is to increase customer satisfaction through right-in-time deliveries. Additionally, these lean principles enable the case company to control operations in every stage of the supply chain to efficiently way by concentrating constant improvements. Effective supply chain management can be implemented by lean management principles which are illustrated in Table 1.

Table 3. Lean principles and tools (Lambert 2008, 219)

Principle	Tools and practices
Waste reduction	Value stream mapping, Problem solving, Genchi Genbutsu (go to where work is done), Five why's
Just-In-Time	Pull system, Quick Changeover, One-Piece and Continuous flow, Kanban, Heijunka (Leveled Production), Takt Time Planning
Jidoka ("Make problems visible")	Visual tools, 5S, Poka Yoka (error proofing), Andon (highlight and study the problem)
Single-market quality	Stable and Standardized Processes
Continuous improvement	Kaizen (eye for wastes and improvement from everybody everyday), Discipline (to fight complacency and pursue perfection)
Respect for People	Safety, teamwork, training and learning, Shared rewards

In this research the aim is on executing lean thinking principle of waste reduction by using a value stream mapping as a tool. Additionally, wastes are identified as non-value added activities in this research. Therefore, the focus is to use the pattern of value stream mapping as a part of lean thinking and its implementation in the case company.

The main focus of lean thinking is to contain an integrated approach to supply chain operations, dictating that the company specify value, identify the value stream, make value flow, let customers pull their supply and strive towards perfection (Lambert 2008, 219). In other words, it is possible for the company to build effective supply chain management through lean thinking principles. This "value stream" approach refers lean thinking of customers as a center of integration. In other words, customers should play integral role and drive the actions of all upstream supply chain members. However, this requires that management not only be aware of but actively manage the operational interfaces with key suppliers and customers in order to meet the needs of the end-customer. This integrated approach to materials management across the supply

chain as lean supply chain operations, where the flows of physical material and information are coordinated across primary members of the supply chain. This coordinated flow of physical materials helps reduce the wastes across the whole supply chain.

To realize the full benefit of both lean thinking and supply management, “the scope of lean implementations must exceed a single function and should be positioned as part of the management relationships with customer and suppliers” (Lambert 2008, 220). More precisely, truly lean supply chain management should focus on efficiency of physical material and information as well as supply chain participant tight collaboration to gain profitability as well as cost reductions to the company.

The idea of lean management is managing value streams. According to Keyte and Locher (2004, 1) management of value streams involves a process of measuring, understanding, and improving the flow and interactions of all associated tasks to keep the cost, service, and quality of a company products as competitive as possible. Especially view of supply chain functions, Keyte and Locher (2004, 1) divide these value streams to three critical areas of management which are problem solving, information flow and physical transformation. Understanding interaction within these three critical areas build the whole picture of the case company`s present state and help create the ideal future state. Physical transformation includes life-cycle of the product, from raw material to end-product. The effective information flow is essential between every processing stage of product since it drives the physical material flow. Problem solving pursues a fluent and flexible flow of material and information with the goal that the customer will have end-product right-in-time.

3.2 The concept of value and waste

Lean thinking places value as something that the customer is willing to pay for. Value-adding activities transfer physical material and information into something a customer wants. Non-value adding activities include resources and do not directly contribute to the end result desired by the customer. These non-value added activities is seen as

waste and defined as anything that does not add value from the customer's perspective. For instance wastes can be defined defective products, overproduction, inventories, excess motion, processing steps, transportation and waiting. Before creating value stream it is essential to understand the difference between value and waste processes. Sometimes it is not easy to discern the difference when looking at an entire supply chain and the best way is to look at the components of the supply chain and apply lean thinking to each one to determine how to link the processes to reduce waste (Tompkins associates 2010).

3.3 Value stream approach

Value stream mapping help the company see linked chains of processes and to envision future lean value streams. Underlying value stream mapping is a philosophy of how to approach improvement. The main idea is to straighten out the overall flow of the value stream before deep diving into fixing individual processes. The point of improving individual processes is to support the flow whether it concerns physical material, information flow or both (Liker & Meier 2006, 32). According to Tompkins and Harmelink (2004, 380) Value stream mapping approach as a one tool of lean management is focused on creating value as follows:

- Specifying value from the perspective of the end customer
- Determining a value system by:
 - Identifying all of the steps required to create value
 - Mapping the value stream
 - Challenging every step by asking why five times
- Lining up value, creating steps so they occur in rapid processes
- Creating flow with capable, available and adequate processes
- Pulling materials, parts, products and information from customers
- Continuously improving to reduce and eliminate waste

The value stream consists of the value-adding activities required to design, order, and provide a product from concept to launch, order to delivery, and raw materials to

customers. Generally value stream mapping is focused straight to improve material flows through lean manufacturing. However, this research will aim on improving effectiveness of information flow through supply chain management and differ at some points from value stream mapping as its normal form, since objective is in information flow. When developing a value stream map for a product the first step is to select a product family and collect all available process information. After product family have been chosen it is important to continue to map the steps in sequence and by information flow. This is called the current state map and it provides a clear picture of the processing steps and information flow for the process as it exists today.

When creating current state map concerning information flow within supply chain and as a focus to increase effectiveness through efficient supply chain management it is essential to research activities behind the objective. In this study the product family is seen as the order-delivery process and internal patterns which are the center part of the research. Firstly, it is essential to separate all supply chain functions in each blocks with information flow as a starting and ending point of the supply chain. Supply chain consists of several independent functions. When aligning the perspective of effective supply chain as one entity it is essential to point out supply chain`s functionality while creating current state map. Additionally, it is important to define the supply chain collaboration level and models used in supply chain collaboration and how they are recognized to influence to effectiveness of information flow.

When creating ideal future state map it is essential to realize that it is based on the current state map with improvements defined. The future state map focuses the direction of a new design for the value stream and its intended performance at a point in a lean transformation (Keyte & Locher 2004, 7). Considerable is that future state describes how the value stream should operate over a wide range timelines and it should be updated once a year to see improvements which have been achieved as well as constantly solving new problems that arises.

In lean thinking, value stream mapping, the idea is to achieve common goal through teamwork over supply chain boundaries. One enabler to lean supply chain is cross

functional collaboration. These “creative times” in we are now living are highly valuable in keeping the teams, and hence the organization, innovative and to continuously improve the manufacturing process. However, as lean practices reach the extreme, the shrinking size of the workforce and the busy schedules of employees who have multiple responsibilities will make it much harder to get workers together for formal discussion, much less casual chats that may spark innovative changes (Chen, Lindeke & Wyrick, 2010). In other words value creation through lean supply chain is based on efficient supply chain collaboration when there is given enough time and resources of maintain cross functional teams.

3.4 Performance measurement

When creating lean supply chain through value stream mapping approach it is necessity to define performance measures. Only by that it is possible to constantly follow up and straighten direction toward to ideal future state. Delivery accuracy and inventory levels are the main performance measures in this thesis. The main focus is by step-by-step improvements increase delivery accuracy and decrease inventories. Delivery accuracy can be seen as the external measure of the company. In some point it reveals customers satisfaction through right-in-time deliveries. However, it has to be noticed that beside delivery accuracy the amount of reclamations measures customer satisfaction. The reason why these two performance measures have been chosen is that they are officially the main measures in the case company and are highly influenced by effective supply chain management and efficient information flow.

4 RESEARCH METHODOLOGY

In the following chapters the research strategy, qualitative approach as well as data collection concerning this research are presented.

4.1 Research strategy

Research strategy can be identified as an entity of research methods solutions. According to (Walsh & Wiggins 2003, 70) research strategy is a decision about the data collection tactics to be used. It steers choices of research methods as well as use of them in theory and in practice. It is essential to notice that research strategy effect to chosen study whether it is case study, experiment or survey. This thesis research strategy is tightly constructed on exploring and explanatory of issues influencing studied phenomena and the chosen strategy is case study. The nature of research questions and their formulation influenced choosing case study approach as a research strategy.

When selecting research strategy it is essential to realize that each strategy has particular advantages and disadvantages. In addition, the use of each strategy depends on three conditions which are the type of research question posed, the extent of control the researcher has over actual behavioral events and the degree of focus on contemporary as opposed to historical events (Yin 2003, 5). According to Ghauri and Gronhaug (2004, 115) the case study is preferred approach when `how` or `why` questions are to be answered when the researcher has little control over behavioral events and when the focus is on a current phenomena in a real-life context. Yin (2003, 7) by stating that when “how and “when” question is being asked about a contemporary set of events, over which the investigator has little or no control the case study is appropriate choice for the research strategy. In this study the focus is on contemporary events and there is no control on behavioral events.

This research is a single case study, even though there is also choice of multiple case study or cross-sectional case study. As this research is about a single case study

rationale for representative case its objective is to capture the circumstances and conditions of an everyday or commonplace situation (Yin 2003, 41). According to Klenke (2008, 64) single case studies are appropriate if they represent unique situations or extreme cases such as specific organizations. In this research the case company represents large global steel company. Business environment is focused increasingly between supply chains instead of between companies.

4.2 Qualitative approach

When using single case study as a research strategy it is often deceptively connected to qualitative research approach. Even though in this thesis qualitative research approach is chosen it is essential to emphasize that in case study qualitative research, quantitative research or mix of both can be used. According to Piekkari – Marschan and Welch (2011, 6) it is important to note that, while the case study is typically combined with qualitative methods, this does not preclude the use of quantitative methods: ‘case study is not synonymous with qualitative methods’. However, intention of both quantitative research and qualitative research is strive to generate knowledge.

This thesis is based on qualitative research approach, since it study effective information flow through supply chain management by using one of the lean management method, value stream mapping as a tool. The nature of this research is a qualitative research, which refers to a research where the data is collected comprehensively from real life situations (Hirsjärvi & Remes & Sajavaara 2008, 160). In addition, qualitative research methods have been defined as procedures for coming to terms with the meaning not the frequency of a phenomena by studying it in its social context (Marschan - Piekkari & Welch 2004, 6). Both of these statements support the aim of this research by exploring and evaluating non-value added activities as well as value added activities effecting to the information flow within the supply chain of the case company. Hence qualitative research methods strength is that they can illuminate issues and turn up possible explanations: essentially search for meaning – as is all research. According to Gillham (2000, 10) qualitative research methods focus primarily on the kind of evidence that will enable researcher to understand of the

meaning what is going on through such tools as an observation and interviews. Gillham (2000, 10) continues that the strength of qualitative methods is that they can illuminate issues and turn up possible explanations: essentially a search for meaning. Qualitative research approach in this single case study brings valuable insights and knowledge of people behavior. It also helps to understand hidden opinions and causes effecting to phenomena under research.

4.3 Data collection and analysis

The case study research enables the researcher to draw upon many approaches to data collection because case study does not claim any particular methods for data collection. Data collected for case study are seen as evidence and can be collected by using several sources. According to Yin (2003, 83) these sources are defined as follows; documents, archival records, interviews, direct observation, participant-observation and physical artifacts. When using qualitative methods, data collection is usually gathered through interviews, observations and documents. In addition, multiple sources enable the researcher to address a broad range of issues within the case study. In addition, it also allows the researcher combine the findings of the case study. In this research data was collected through semi-structured interviews, participant-observation and internal documents. The use of multiple sources of evidence allows wide viewpoint of the research objective and increase the reliability of the research.

Primary data concerning this research`s order-delivery process part was collected through semi-structured interviews with interviewees from the Logistics service department, the Commercial department and the Production planning department. Interviews were held on each department so that environment would be comfortable for interviewees to express freely their feelings. Face-to-face individually executed interviews enabled also the possibility to ask clarification for given answers. However, that increased multilateral of answers and gave challenge to pick up relevant issues concerning research objective. In addition, my own experience as a production planner

was in essential role when evaluating non-value added areas in information flow within the case company's supply chain.

Interviewees were chosen based on their knowledge and background in the case company. Since the research area turned out to be wide it was reasonable to choose the operational level as a target to interviews. In addition, my own experience and earlier conversations with colleagues from the Commercial department and from the Production planning department showed out the importance of research concerning the chosen area from the perspective of the operational level.

The data concerning internal patterns was achieved both through the participant observation as well as conversations within employees who are involved daily basis with these patterns. The data derived through the participant observation is the data gathered in weekly meetings in the Production planning department as well as regular meetings with the production planning manager and the development manager concerning this research. Conversations with commercial coordinators and production planners enabled to describe the current situation concerning internal patterns. Additionally, conversations enabled to set more questions for clarifying certain issues during the research. Internal documents concerning internal patterns were in use and helped to build the understanding of these patterns.

5 THE CASE COMPANY OUTOKUMPU STAINLESS TORNIO WORKS

The case company Outokumpu Stainless Oy Tornio Works is a part of the Outokumpu Group which is one of the world's largest producer of stainless steel. Outokumpu has over 40 years of experience as a stainless steel producer although the company's routes extend all the way to the year 1910 when the copper ore mine was found in the city of Outokumpu, Finland. From the year 1914 to the year 1964 the company's main business area was produce copper products and the markets were Finland centric. (Särkikoski 2005, 39). Today the company is a global player in the stainless steel with several operations worldwide and its main production facilities are located in Sweden, the UK, the Us, the Netherlands and in Finland. The company's annual sales were 4229 million euros in the year 2010 (2009: 2641 million) and it employees 8104 people globally (Outokumpu 2010b).

The case company Outokumpu Tornio Works is Outokumpu Groups largest facility with the world cost-efficient and highly-integrated production of the high-volume standard grades of stainless steel. Tornio Works consists of three units, Kemi chromite mine, Tornio Ferrochrome and stainless steel production and the cutting- and slitting production in Terneuzen, Netherlands. The integration from the beginning to the end production makes the case company important to Outokumpu Group because the location of the units close to each other, including Terneuzen unit. The production process begins nearby in the Kemi chromite mine and continues in to the Tornio Ferrochrome smelter and finally through the hot rolling and cold rolling mills in Tornio from which the products are delivered forward (Outokumpu 2010b).

Outokumpu Groups business is divided to general and special stainless steel. The case company production is based on general stainless steel with high-volume standard grades products consists of hot- and cold rolled coils and sheets which are mainly used in industrial segments such as chemicals and petrochemicals, construction and energy related industry, pulp and paper, gathering and households. The customers of the case company are distributors and processors who stock the products and serve the end-users from the mentioned main areas (Outokumpu 2010a).

5.1 Order – delivery process and internal patterns

In the case company supply chain collaboration is seen at the operational level in day-to-day work as tight information sharing between the Commercial department, the Production department and the Logistics services department. Information sharing within these departments is managed through emails and phone calls which enables quick actions concerning customer orders. However, the main flow of information concerning customer orders flows through information systems. In the case company the order –delivery process include gross amount of orders and are separated from internal patterns.

6 EMPIRICAL FINDINGS OF THE RESEARCH

The empirical part of this thesis, which was conducted in the form of interviews, included the following three main themes; general questions based on the knowledge and the working tasks of the interviewees, questions concerning delivery accuracy and information flow in general as well as the information systems impact in information flow within supply chain. There were accommodate questions concerning collaboration within in the supply chain and the use of internal information sources to find out functionality of order-delivery process. In view of M6, Master distributor flow and Decoupling buffer, interviews were revealed through open conversations within employees who are a part of cross functional teams handling daily these internal patterns. In addition, the current- and the future state maps are created separately and given to the case company`s use.

Interviews concerning the order-delivery process were realized in Outokumpu Tornio Works supply chain departments which included the Production planning- and the Logistics services department, the Technical customer service department and the Commercial department. As the purpose of the research was an understanding of a current and future state situation through value stream mapping at the operational level the main part of the interviewees work as employees in the departments. This will give a true insight view of existing challenges, possibilities and motivation to push and monitor the orders from order input to order delivery. The persons interviewed within this thesis were as listed below:

- Commercial coordinator (German wholesalers and end-users)
- Commercial coordinator (North- and South America wholesalers and end-users)
- Customer service engineer (Customers from Southern Europe)
- System developer, SAP super user (Focus), the Logistics service department
- Export- and IT-coordinator, the Logistics service department
- Development planner, SAP super user (Focus), the Production planning department
- Production planner, the Production planning department

In addition, relevant information to this thesis was received through the weekly monitoring meetings with the Production planning engineer and the Supply chain development manager in the autumn 2010. Also the data for the delivery accuracy, value stream mapping and internal information sources were gathered through the documents and reports which are in use in the case company. In addition, to these data resources essential is my own knowledge and experience as I am a part of the supply chain. At this point it is essential to notice that the current- and future state maps are created separately based on outcomes of the interviews, observations and internal documents. Furthermore, the state maps have already been given to the case company's use.

The subjectivity concerning the results of the thesis is shown in some point in this thesis although the main focus is to find out the current situation and to create an ideal future situation through research methods used in this thesis. As I was the interviewer in the empirical part, it influenced somewhat to the direction of answers as well as the form of the interview.

The main aim of the empirical part of this thesis was to collect information for describing the information flow within the supply chain and point out the stumbling blocks. In addition, to find out the ways to increase delivery accuracy as well as to decrease inventories and through that enhance customer satisfaction.

7 DISCUSSIONS AND CONCLUSIONS

There were three research questions for this thesis; How efficient is Outokumpu Tornio Works` supply chain collaboration at this moment? Which non-value added activities impact on information flow within the supply chain of Outokumpu Tornio Works`? How are non-value added activities transplanted to value creation to gain competitive advantage? In this chapter, the main aim is to analyze the Empirical findings, reflect them towards the Literature review as well as the Analytical framework and suggest improvements under this research topic. The suggestions for improvements are included in the future state maps concerning the order-delivery process and the internal patterns.

7.2 The summary of the thesis

The general aim of this thesis was to research information flow within the supply chain of the case company Outokumpu Tornio Works by following one of the lean management principles, value stream mapping. Research questions which were answered are as follows: How efficient is Outokumpu Tornio Works` supply chain collaboration at this moment? Which non-value added activities impact on information flow within the supply chain of Outokumpu Tornio Works`? How are non-value added activities transplanted to value creation to gain competitive advantage? As a result the current state and the future state maps concerning the order-delivery process and internal patterns were created.

The questions in the value creation perspective support the value stream mappings idea to add value instead of support wastes. It also can be said that the objectives of this thesis have been achieved, since several non-value added activities is found as well as suggestions to transplant them as value creation to improve supply chain performance of Outokumpu Tornio Works.

This thesis was based on qualitative research with a single-case study approach by using multiple sources such as semi-structured interviews, participant observations

and internal documents. Additionally, my own experiences as an employee in the Production planning department were used when conducting the research in the thesis.

Chapter 5 Case Company, Chapter 6 Empirical findings, and Chapter 7 Discussions are regarded as including confidential information and therefor they are not published in their full length in the Library database.

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INTERVIEW QUESTIONS – EMPIRICAL STUDY OF OUTOKUMPU TORNIO WORKS

General questions

1. What is included in your daily tasks?
 - How long have you been working in Outokumpu Tornio Works?
 - How long time have you performed the present task?
 - What are your main areas of responsibility in this task?
2. Do you know your department`s main responsibilities?

Supply chain

3. What are the general aims and goals in the supply chain process?
4. How well do you know other participants in the supply chain?
5. Do you know other department`s tasks in the supply chain?

Collaboration within supply chain/ your own department

6. Is there enough collaboration between departments?
7. How can this collaboration be improved?
8. How does the collaboration impact on customer satisfaction?
9. Do you have regular meetings with other departments in the order-supply chain?
 - a. What is the purpose of those meetings?
 - b. How could those meetings be improved to achieve a higher collaboration level?

10. Do you have intra-departmental meetings at your own department?
 - a. What is the purpose of those meetings?
 - b. How could these meetings be improved to make them benefit your daily work performance?

Information flow within supply chain

11. How does the information flow within the supply chain influence your daily work?
 - What are the problems arising from the information flow within the supply chain?
 - How do the information systems influence the information flow?
12. Do you have any suggestions for improving the information flow to achieve enhanced customer satisfaction?

Delivery accuracy

13. How do your daily tasks influence delivery accuracy?
14. What is the importance of delivery accuracy reporting?
15. What is your opinion concerning delivery accuracy reporting?

Internal reports and manuals as a source of information

16. Are there shared internal reports or manuals to be used as a source of information in Outokumpu Tornio Works which facilitate your daily work performance?
 - How well do you know those internal reports or manuals?
 - In what ways can you take advantage of them in your work?

Haastattelukysymykset – Empiirinen tutkimus Outokumpu Tornio Works**Yleisiä kysymyksiä**

1. Mitä kuuluu päivittäisiin työtehtäviisi?
 - Kauanko olet työskennellyt Outokumpu Tornio Worksin palveluksessa?
 - Kauanko olet työskennellyt nykyisessä tehtävässäsi?
 - Mitkä ovat päävastuualueesi tässä tehtävässä?
2. Tunnetko osastosi vastuualueet?

Tilaus-toimitusketju

3. Mitkä ovat tilaus-toimitusketjun yhteiset tavoitteet ja päämäärät?
4. Kuinka hyvin tunnet muut tilaus-toimitusketjun osapuolet?
5. Tiedätkö muiden tilaus-toimitusketjun osastojen työtehtäviä?

Yhteistyön merkitys tilaus-toimitusketjussa sekä omalla osastolla

6. Onko osastojen välillä mielestäsi tarpeeksi yhteistyötä?
 - Miten yhteistyötä voitaisiin parantaa?
 - Mitä vaikutusta yhteistyöllä on asiakastyytyväisyyteen?
7. Onko teillä säännöllisiä kokouksia muiden tilaus-toimitusketjun osapuolten kanssa?
 - Mikä näiden kokousten tarkoitus on?
 - Kuinka tapaamisia voitaisiin parantaa, jotta yhteistyö olisi parempaa?

8. Onko teillä säännöllisiä osaston sisäisiä kokouksia?
- Mikä näiden kokousten tarkoitus on?
 - Miten kokouksia voitaisiin parantaa, jotta niistä olisi hyötyä sinulle jokapäiväisessä työssäsi?

Tiedonkulku tilaus-toimitusketjussa

9. Miten tiedonkulku tilaus-toimitusketjussa vaikuttaa päivittäiseen työhösi?
- Mitä ongelmia tilaus – toimitusketjun tiedonkulussa mielestäsi ilmenee?
 - Kuinka tietojärjestelmät vaikuttavat tiedonkulkuun?
10. Onko sinulla ehdotuksia kuinka parantaa tiedonkulkua, jotta saavutettaisiin parempi toimitusvarmuus sekä asiakastyytyväisyys?

Toimitusvarmuus

11. Miten päivittävät työtehtäväsi vaikuttavat toimitusvarmuuteen?
12. Mikä on toimitusvarmuuden raportoinnin tarkoitus?
13. Mitä mieltä olet toimitusvarmuuden raportoinnista?

Sisäiset raportit ja ohjeet tiedon lähteenä

14. Onko Outokumpu Tornio Worksilla sisäisiä raportteja tai ohjeita, jotka auttavat päivittäisissä työtehtävissäsi?
15. Kuinka hyvin tunnet nämä sisäiset raportit ja ohjeet?
16. Kuinka voit hyödyntää niitä työssäsi?

