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Introducing an effective inbound logistics concept to the automotive industry

Preparing a Milk-Run –transportation plan for Valmet Automotive Ltd

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Bachelor's thesis
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Degree Programme in International Business
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Abstract

The objective of the study was to create a preliminary model of a milk-run logistics concept to Valmet Automotive Ltd. The aim of introducing a particular logistics concept was to improve the company's inbound logistics flow leading to a cost-advantage in the firm's value chain.

The theoretical part consists of a theory about supply chain and value chain, and more specifically, the inbound logistics and milk-run logistics concept in the automotive industry.

Action research was used as the research approach to let the author have more options for how to solve the research questions. The research consists of different action cycles repeated during the research process. In the beginning, the needs of the company were identified. Consequently, the starting basis and the first draft of the milk-run plan were prepared. After each action, there was a development discussion, which raised new ideas and suggestions for improvements. The changes were made out according to the results from the development discussions. The research contained four different cycles repeated four times, and the final reflection was the final feedback on the milk-run transport plan. The empirical part of the report includes a narrative of how the study was conducted, and what was done in the different stages.

As the result of the study, the milk-run logistics concept was introduced to Valmet Automotive Ltd. by preparing a milk-run transportation plan. The implementation of the Milk-Run transportation plan could be further studied in the future from the perspective of cost-efficiency, environmental-friendliness and the material flow in inbound logistics.

Keywords/tags (subjects)

action research, Supply chain, value chain, automotive industry, inbound logistics, milk-run logistics, Milk-run transportation plan, JIT-time delivery

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Tehokas tulologistiikan kuljetus-konsepti autoteollisuudessa

Milk-Run-kuljetussuunnitelman luominen Valmet Automotive Oy:lle

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Tiivistelmä

Tutkimuksen tarkoituksena oli luoda Valmet Automotive Oy:lle potentiaalinen tulologistiikan ”Milk-Run”-kuljetuskonsepti-malli. Kuljetuskonseptin luomisen tarkoituksena oli parantaa yrityksen tulologistiikan virtausta ja täten kasvattaa yrityksen tulologistiikan kustannustehokkuutta arvoketjussa.

Tutkimuksen teoreettinen osuus koostui toimitusketjun ja arvoketjun yleiskatsauksesta sekä tulologistiikasta ja Milk-run-logistiikan konseptista autoteollisuudessa.

Tutkimusmenetelmä oli toimintatutkimus. Toiminnallinen tutkimusmenetelmä valittiin, jotta tekijällä olisi enemmän vaihtoehtoja tutkimuskysymyksien vastausten saavuttamiseksi. Tutkimusote oli laadullinen, ja aineisto empiiriseen tutkimukseen kerättiin pääosin kehityskeskusteluilla.

Tutkimus koostui erilaisista tutkimuksen aikana toistuvista sykleistä. Aluksi yrityksen tarpeet havaittiin, minkä seurauksena tehtiin pohjustus tutkimuksen aloitusta varten. Ensimmäinen Milk-run-kuljetussuunnitelman luonnos käsiteltiin ensimmäisessä kehityskeskustelussa, jonka tuloksena luonnokseen tehtiin muutoksia. Tutkimus koostui neljästä eri syklistä, eli edellä mainittu toiminta toistui neljä kertaa tutkimuksen aikana. Sykli sulkeutui Milk-run-kuljetussuunnitelman loppupalautteen saamiseen. Työn empiirinen osuus koostui työn eri vaiheiden yksityiskohtaisesta selostuksesta.

Tutkimuksen tuloksena potentiaalinen Milk-run-kuljetuskonsepti esiteltiin Valmet Automotive Oy:lle laatimalla Milk-Run-kuljetussuunnitelma. Milk-Run kuljetussuunnitelman käyttöönottoa voidaan tutkia tulevaisuudessa muun muassa sen kustannustehokkuuden, ympäristöystävällisyyden ja jatkuvan tavaravirran jakelun näkökulmista.

Avainsanat (asiasanat)

Toimintatutkimus, Toimitusketju, arvoketju, autoteollisuus, tulologistiikka, Milk-run logistiikka, Milk-run kuljetussuunnitelma, JIT-toimitus

Muut tiedot

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1 INTRODUCTION

1.1 Creating value by planning firm's inbound logistics processes

In the nowadays hectic business life, it is probably more actual than ever for companies to refine their strategies in each level in the supply chains to reduce costs. Logistics is one area in the supply chain which has different strategies and the logistics managers of the companies are trying to refine those strategies according to the latest trends.

According to Robert Murray (president of Princeton, N.J.-based consulting firm REM Associates), the biggest problem of the companies is that there is not enough attention to the inbound freight issues such as purchasing operations. Often, this is a result of the fact that there is a problem of an entrenched organization where the changes are not easy to implement. Business is changing from local to global and thus there must be a constant control on how to implement in to a current business life in the most cost-efficient way and still stay competitive. (Harrington 2008)

A value chain is the concept which helps to control companies' operations which are affecting to the firms' cost -and value advantage. Inbound logistics, which is the main topic during this report, is one part of the value chain. There are several published articles and studies about inbound logistics and procurement in automobile industry but the main concentration seems to be on the distribution of final products. Nevertheless, inbound logistics has an important role in a supply chain as it affects to the whole upcoming supply chain processes. Inbound logistics is also one of the key cost factors in the supply chain.

Over the years, it has been suggested by educators, service providers and consultants that the companies should pay more attention to a constant inbound logistics management. By considering inbound logistics, companies can save big amounts of money but also the reliability of the production becomes more robust. (Harrington 2008)

This research was conducted for a Finnish car manufacturer Valmet Automotive Ltd. The author got the topic of this research while working as a summer trainee in the logistics department at Valmet Automotive. The author was participating in an inbound logistics planning project and the task was to introduce a Milk-run logistics concept which is improving the company's inbound logistics flow in a cost-efficient and more logical way. The idea of widening the project into a thesis study became from the author's enthusiasm towards the milk-run logistics concept during the project.

The objectives of this research were to introduce a milk-run based logistics principle to Valmet Automotive Ltd. A concrete milk-run transportation plan was expected to be prepared during this study. Also, the enablers and challengers were considered when implementing the milk-run plan.

1.2 Objective of the research

The objective of this research is to study the importance of the inbound logistics in the company's supply chain.

The research questions are:

- "What kind of milk-run -based inbound logistics principle can be introduced to the company to improve its inbound logistics flow?"
- "What are the enablers and challengers to take this concept in use?"

As the aim of this study is to improve the inbound logistics flow of Valmet Automotive, the research objective can be formulated as follows:

"The objective of this study is to improve the inbound logistics flow concerning the Eastern-European area in a way that the changes affected by the milk-run logistics concept will be cost-efficient and more functional for Valmet Automotive.

1.3 Valmet Automotive Oy

Valmet Automotive Oy is a predominant Finnish service provider. It has four core areas of concentration which are automotive engineering, vehicle manufacturing, convertible roof systems and related business services. The main office is located in Uusikaupunki, Finland. (Valmet Automotive 2014)

The company was established in 1968, when the Finnish Valmet and the Swedish Saab-Scania contracted a joint venture in Uusikaupunki, Finland. The prospect was not only to develop automotive know-how in Finland but also offer new jobs and create an awareness of the automobile industry. Saab was first produced for the domestic markets but the high quality enabled the markets to expand to abroad later on. (Valmet Automotive 2014)

Since 1992, Valmet was the only owner of the company and concentrated on contract manufacturing at that time. In 1995, the company changed its name to Valmet Automotive. The Metso Group was the sole owner of Valmet Automotive during 1999-2010. Since 2010, Metso Corporation and the Finnish investment companies Pontos Group and Finnish industry Investment Ltd have been major shareholders of the company. (Valmet Automotive 2014)

The company's vision is: ***"a leading engineering-driven automotive service provider creating growth and customer success."***

Customer promise: ***"Design, Quality, Success!"***

Commitment: ***"customer satisfaction"***

Figure 1. The company's values. (Valmet Automotive 2014)

The company's values consist of best quality performance, customer success creation and innovating together. (Valmet Automotive 2014)

In the growing global economy it is vital to have connections all over the world. The company's main production plant is located in Uusikaupunki, in the western coast of Finland. Other production plants are located in Germany (Osnabrück) and Poland (Zary). Moreover, the company has an office in Shanghai. The company's strategic focus is on international growth and operations. (Valmet Automotive 2014)

Figure 2. The company has production in Finland, Poland, Germany and China. (Valmet Automotive 2014)

Valmet Automotive focuses on producing premium cars, convertibles and electric vehicles. The company has expanded to Finland, Germany, Poland, Sweden, China and the USA, and employs 1700 people in these countries. The company has nowadays an assembly line also in China, South Korea, Sweden and the USA. (Valmet Automotive 2014)

Valmet Automotive has produced several different cars over the decades. Those are Saab 95, Saab 96, Saab 99, Saab 90, Saab 9000, Saab 900, Saab 900/ 9-3 Convertible, Saab 9-3 3D and 5D. Saab cars were produced during 1969-2003. Porsche Boxter and Porsche Cayman cars were produced during 1997-2011. The production of THINK City and Garia Golf-Cars started in 2009 and ended in 2011. The Fisker Karma project started in 2011 but is currently on hold. Other car products which have been manufactured in the company's manufacturing plant are Chrysler-Talbot, Opel Calibra and Euro-Samara. (Valmet Automotive 2014)

Figure 3. Currently, Valmet Automotive manufactures Mercedes Benz A - Class cars. (Valmet Automotive 2014)

Currently, the company has a contract with Daimler AG to produce over 100 000 Mercedes Benz A –class cars during 2013-2016. The production started in August, 2013. Daimler AG is not only a customer of Mercedes Benz A-class cars, but also a customer of convertible roof systems in Valmet Automotive. Recently, Valmet has acquired references such as Fisker Automotive, Garia A/S, THINK Global and Porsche AG. Along with car manufacturing, Valmet Automotive provides consulting services and engineering knowhow for the companies from the same industry. (Valmet Automotive, 2014)

1.4 Research methods

Research methods are a set of rules and procedures. A research method can be defined as a tool to solve problems: when the research problem has been identified, the research method is the tool to carry out the process and find solutions or answers to the problem. (Ghauri & Grønhaug 2005, 40)

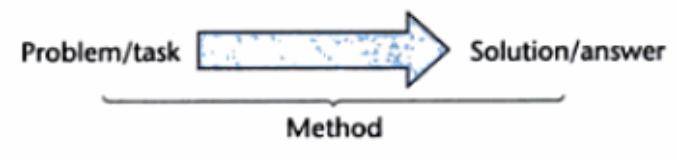

Figure 4. A research method is the tool to solve research problems (Ghauri & Grønhaug 2005, 40)

The research purpose defines whether to use qualitative or quantitative data collection methods.

Qualitative approach is about holistic understanding of the studied objective, whereas quantitative methods are more abstract by having standardized and structured approaches to collect and analyze the empirical data. Quantitative data method includes testing of hypotheses, statistical analysis and explanations. (Eriksson & Kovalainen 2008, 5)

It is not easy to compare qualitative and quantitative data research approaches, but according to Eriksson and Kovalainen (2008, 4), the main difference between qualitative and quantitative research method is that "quantitative research cannot deal with the social and cultural construction of its own 'variables'."

As this study was based on verbal interaction and did not contain numerical data analysis, the data collection method for the empirical part in this study was qualitative: there were many developmental discussions with the concerned members in the organization. Also, a questionnaire was prepared about the key questions concerning the milk-run transportation plan. Moreover, there were a lot of graphical analysis which was also one key point when brainstorming the benefits of the milk-run transportation in practice. Other qualitative data collection was linked to the data about different suppliers and their location and volume details. Those details were considered when planning optimal milk-run routes in the area of Eastern-European suppliers.

1.5 Research Approach

As the research questions involved developing a Milk-run transportation plan for Valmet Automotive Ltd, action research was the best option for the purpose.

Action research has several synonyms; participatory research, collaborative inquiry, emancipatory research, action learning, and contextual action research, depending on the context of the study. (O`Brien, 1998)

Action research typically has four different steps of actions which are planning, acting, observing and reflecting. (Zuber-Skerritt 2002, 130)

Action research is kind of a holistic approach to problem solving. Thus, there are several different ways to collect and analyze relevant data in action research. Both qualitative and quantitative data collection methods are allowed, but in this particular research, the approach is often qualitative. For example, participant observation recordings, questionnaire surveys, structured and unstructured interviews, document collection and analysis, and case studies are qualitative data collection methods which are commonly used in action researches. (O´Brien 1998)

Simply, the purpose of action research is *"learning by doing", which means that the learning process will happen by doing and reflecting. There is a group of people which identifies a problem. Consequently, the group will act in order to solve the problem. The next steps is to view the results and if there is something to improve or do differently, the group will repeat the process. (O`Brien, 1998)

Below, there is a spiral of the steps included in action research. As the figure shows, the process is carried out in an iterative and cyclical style. Each action will lead to a greater understanding of the problem and thus it becomes easier to reach the objectives (Riel, 2010)

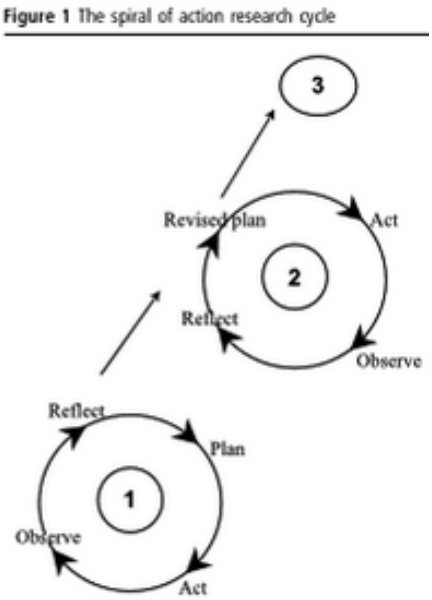

Figure 5. The spiral of the action research cycle (Zuber-Skerritt 2002, 130)

Why action research?

The author decided to choose action research as a research method because action research is used in real-life situations (O'Brien, 1998).

As the study assignor is a company, action research method was a reasonable choice. Also, the whole research process was suitable for this study. One of the main features of the action research style is to study a system and give the input to the right direction with the participating group as a whole. The whole study started by studying the inbound logistics flow at Valmet Automotive.

The cyclical process in action research is similar to the method in which the empirical part was done: the first step is planning, then acting, observing and reflecting. After each step there is a lot of interaction between the members of the staff, and by developing new ideas together it has been easier to improve and develop the Milk-run transportation plan. It is typical in action research to cooperate constantly with other people in the organization so that both parties are able to learn during the change process. The research process was divided into four different cycles and in each cycle there was a strong transaction between the concerned parties. Verbal communication during face-to-face discussions enabled the author to improve the transportation plan further.

The starting point of this research is naturally a problem which is identified: there is an illogical inbound logistics flow from the area of Eastern European suppliers and thus the delivery of part-supplies from there needs to be developed. The next step is to explore possible solutions for the problem. The possible solution is probably a milk-run transportation plan which enables more economical, environmental-friendly and sufficient flow of car-parts from Eastern-European suppliers.

To sum up the research process, all the relevant data was collected and a milk-run transportation plan was prepared according to the applicable theory which states that Milk-run logistics could be an answer for this particular problem. The first draft was introduced to Valmet Automotive and afterwards it has been improved with a help of development discussions and iterative actions. This has happened in a cyclical manner: according to the feedback in development discussions, the changes have

been made and the cycle (plan, act, observe and reflect) has been repeated as many times as it was needed.

1.6 Reporting

This report has been divided into two parts: Theory and research. It will first cover theoretical part of the topic and after that it will continue to the empirical part.

In order to tell about all the steps during the research process and to make sure that the reader is able to understand each step in the empirical part of the study, a narrative structure of reporting was chosen.

Narrative can be compared to story-telling: it is a way of describing something in detail. According to Löytönen (2007), narrative contains a situation, people, and the plot. The plot has naturally the starting point, middle point and the end.

Narrative inquiry is typical when the objective of research are biographies, stories or narratives, or change processes, for instance. As the aim of this study is to refine the inbound logistics functions of the company, a narrative is a suitable way of reporting the course of events. (Löytönen, 2007)

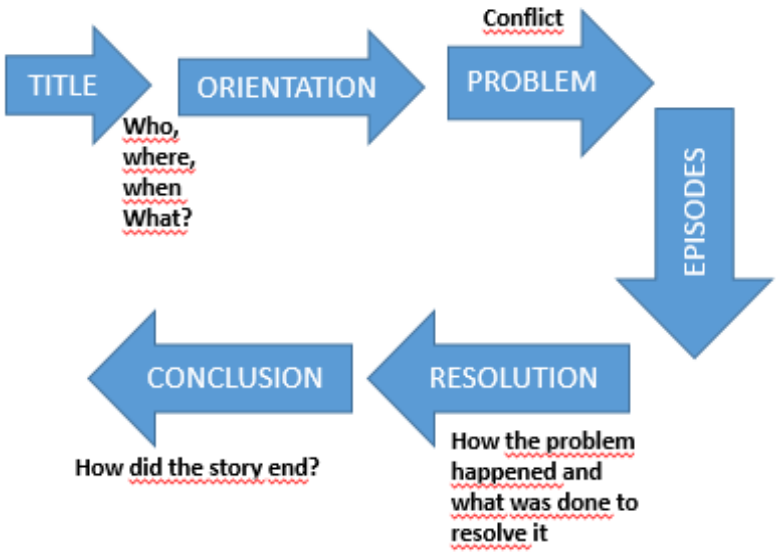

Figure 6. A narrative structure model. (BlockWhitz 2010)

2 VALUE CHAIN

It can be argued that the aim of every firm in the globe is to provide best possible service and gain customer satisfaction. Firms, which are not competitive in the nowadays markets, go bankrupt. Thus, it is vital for companies to consider their operations in a big picture and try to find solutions on how to keep competitiveness and create more value.

A value chain is a concept created by Michael Porter in 1985. The aim of the value chain is to increase a firm's competitive advantage. Competitive advantage stems from the performance of a company in the areas of designing, marketing, delivering, producing and supporting their product. All of these areas are able to affect the firm's cost position: competitive advantage can be achieved by creating effective strategies and by putting those strategies in to practice. Consequently, the firm is able to be either cheaper or better than its competitor. (Christopher 2005, 13)

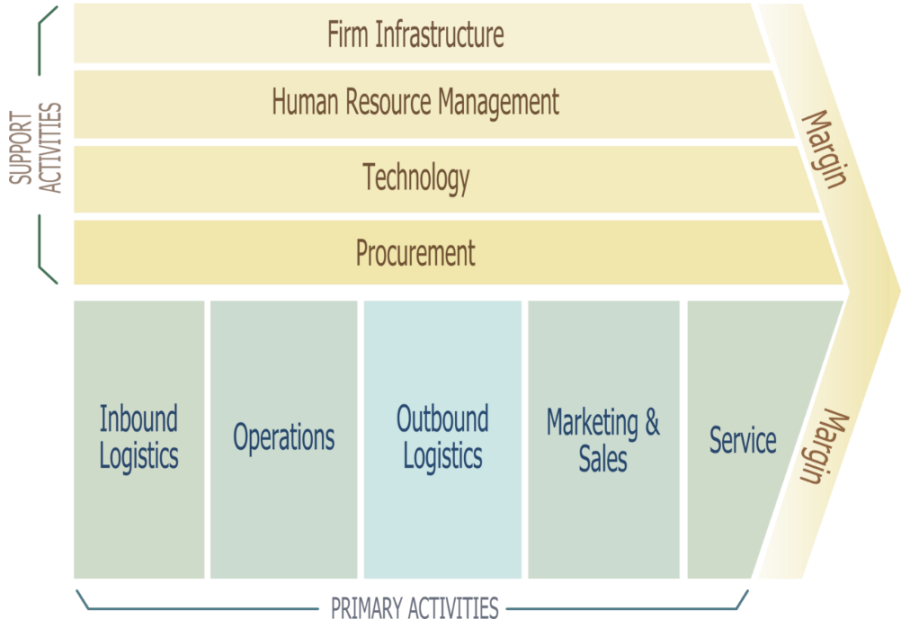

Figure 7. Michael Porter's value chain model (Singh Pratap 2009)

Porter has divided activities in the value chain into two different categories; primary and support activities. Primary activities include inbound logistics, operations, outbound logistics, marketing & sales, and services. Inbound logistics in the value

chain means the relationships with suppliers. It includes the activities needed for delivering, warehousing and disseminating supplies. Operations include actions which are changing inputs to outputs. Outbound logistics is about collecting, storing and distributing the final product. Marketing and sales actions are about informing and persuading customers to purchase new products or services. The service part concentrates on the information flow after the product is purchased and delivered: the concentration is on the fact whether the product has been working efficiently or not. (Cambridge University, IFM)

The support activities are Firm Infrastructure, Human Resource Management, Technology and Procurement. Firm Infrastructure contains functions or different departments, for example accounting, financing and planning. Human Resource Management is about actions regarding personnel (recruiting, layoffs, training) Technology deals with IT-operations (software, hardware, technical knowledge) which help to change inputs to outputs. Procurement is about acquiring raw materials or other resources to make outputs. (University of Cambridge, IFM)

To sum up, a value chain is a concept with a number of activities to create value. Those actions are in companies' supply (raw materials, inbound logistics, and production process) and demand side (outbound logistics, marketing & sales). (Rayport & Sviokla 1995, 76)

2.1 A value chain as a crucial factor when increasing competitive advantage

Inbound logistics is a very vital issue to consider because it affects to the firm's whole supply chain processes.

Competitive advantage can be achieved by cost advantage or value advantage – or preferably both. Cost advantage means lower prices, whereas value advantage is something extra which will make the product more unique than other similar products. It is obvious that by improving the firm's logistics and supply chain management, productivity and efficiency will both increase and thus reduce costs remarkably. (Christopher 2005, 7-8)

It is important for firms to plan their logistics functions well because logistics is one of the major sources of total costs and by planning logistics functions properly the company can, remarkably promote their cost advantage. Actually, logistics management is able to increase both value advantage and cost advantage of a firm: in order to achieve that level, the areas of focus should be capacity utilization, inventory reduction and there should be a closer link to the suppliers as for planning. (Christopher 2005, 11-12)

3 SUPPLY CHAIN CONCEPT

Supply chain is a group of interdependent organizations which are co-operating together in order to transform basic commodities (upstream) into final products (downstream) which are valued by consumers. The aim of each organization in a supply chain is to create value to the final product. (Harrison & Van Hoek 2011, 7)

It can be said that supply chain has already existed for centuries. The first impacts of supply chain can be recognized quite early, for example, when Venice Arsenalotti was able to deliver a warship every 24 hours in 1574. Supply chains also played a major role during the Second World War, too. (Towill, P., Childerhouse & Disney, 2001)

Nevertheless, supply chain management in a deeper sense was first transpired in the 1960s, when the area of physical distribution developed further. At that time, physical distribution was concentrated on a firm's "outbound logistics" which means the logistics process after the product has been manufactured. In 1980's there was the second phase of development in supply chain: "Business logistics" or "integrated logistics" became more popular, and inbound logistics was connected to the outbound side of physical distribution management. (Coyle, Novack, Gibson & Bardi 2011, 17)

Supply chains exist not only in manufacturing organizations but also in service enterprises. However, the challenge of supply chains vary between different industries. Supply chains consist of different organizations which are manufacturing, purchasing, planning, and distribution. Those organizations in supply chains are working independently because they have all their own strategies to execute. (Ganeshan & Harrison 2002, 1-2)

3.1 Supply Chain for automotive industry

When it comes to the supply chains in the automotive industry, there are a few factors which make it full of challenges. A car itself is a special product with several issues to take into account (color, engine, trim and body). Secondly, the supply network in automotive industry is widely spread which makes it a complex: there are hundreds of car dealers and suppliers with their plants in multiple locations. Thus, there must be an accurate planning of the inbound and outbound logistics in order to save time and money. Also, consumer behavior is an important issue: it takes several days to manufacture a car in the assembly. Therefore, customers will decide whether to wait for the product or not. Nowadays, business is hectic which means that time is money. If the cars cannot be sold, they will remain in the warehouse which causes ageing of the stock. Cars are also seasonal products: markets are changing which affects the demand. If there is no demand, there is no production. It is obvious that markets are the most important factor affecting the supply chains. (Turner & Williams 2004, 447-450)

Thus, supply chain management should be actually defined as “demand chain management” because markets manage a chain, not suppliers. (Christopher 2005, 5)

3.2 The role of logistics in a supply chain

Logistics is one important part of action in supply chain. According to Svensson (2001, 116), logistics consists of the part in the supply chain which focus on planning,

implementing and controlling the effective flow and warehousing of goods, services and information from the beginning to the end. The end result needs to satisfy customers' needs. According to this definition, it is obvious that logistics is a sub-set of supply chain management.

Logistics and supply chains are closely linked together. Nevertheless, logistics is a narrower concept than supply chain management: logistics is a framework aiming to create a single plan for the product and information flow in a firm. Supply chain management is seeking connections with other members in the supply chain and is built upon logistics framework. (Christopher 2005, 4)

4 INBOUND LOGISTICS IN SUPPLY CHAIN

4.1 Inbound Logistics for the Automotive Industry

Inbound logistics is a complex in automotive industry. There are hundreds of suppliers in different countries and each supplier are mainly manufacturing particular car-parts. Hence, the transportation network is quite complicated. Another issue of inbound logistics in automotive industry is that inventory levels should be as low as possible.

As the assembly line is continuously running in an automotive manufacturing plant, one of the most important factors in the firm's supply side is to make sure that the inbound logistics functions efficiently. Inbound logistics is not as common a topic to explore as distribution of final products, for instance. It can be argued, that inbound logistics is one of the most crucial field to improve: firstly, inbound logistics is the starting point of the supply process and if something goes wrong at that point, it will affect to all of the following processes. If there are problems in the firm's inbound logistics flow, the worst case is that the assembly line has to stop due to the lack of materials (i.e. parts), which will cost a lot of money.

Thus, it is no wonder that the supply chain managers of each firms have to plan all of the steps in logistics from the point of producing raw materials to the point of delivering final products to customers. (Brar & Saini 2011, 1)

4.2 Just-In-Time –philosophy (JIT)

Just-In-Time (JIT) –principle was created by Japanese Toyota Car-manufacturer. The idea of JIT is to take the course of action when it is needed. That is to say, the car-parts should not be transported to the manufacturing plant until they are needed in the assembly line. The main purpose of the Just-in-time philosophy is to keep zero inventories in the manufacturing plant. (Sople 2007, 87)

According to Sople (2007, 88), the JIT-principle focuses on having the zero inventory in the manufacturing plant. It can be achieved by loading mixed cargo from different suppliers according to the needed volumes in the assembly line. This is defined as a "mixed loading" concept. The just-in-time –delivery is implemented by using the Milk-Run logistics concept.

4.3 Third-party logistics (3PL)

Sometimes, companies are outsourcing different parts of their supply chains. Usually, the part of logistics functions in supply chains are outsourced. Thus, the third-party logistics service provider is operating the company's logistics functions. However, the company is able to maintain their milk-run –trips if the information flow with the 3PL is sufficient. (Jung, Chen & Jeong 2007, 252)

Nowadays, it is a trend for big companies to use third-party service providers. The companies are suffering the lack of competitiveness and they find outsourcing as a solution for that. Usually, the companies are outsourcing due to the following reasons: cost-related factors, lack of resources or expertise in the particular field, geographical issues, or the companies want to have the full focus on core competencies. (Sople 2007, 142-143)

4.4 Transportation networks in automotive industry

There are different transportation networks, for example direct shipping, cross-docking, tailored networks and milk-runs. Direct shipping means that goods or raw materials are transported straight from the seller to the buyer. In a process of cross-docking, products are transported first to the distribution center and then they will be transported further with other products or raw materials which are going to the same destination. Tailored network is a combination of the two above-mentioned transportation options: both full truckloads and less than truckloads are combined. (Hosseini, Shirazi & Karimi 2014, 1)

Milk-run is a cyclic transport system which is operated manually and is transporting raw materials and finished goods by using fixed time schedule and route. There are at least two or more suppliers in a milk run route and the trip ends to an assembly plant where cars are manufactured. (Hosseini et al. 2014, 1-3)

In the case of a full truckload it makes more sense to ship straight from the supplier to the manufacturer. In the case of less than a truckload, the above mentioned transportation networks should be considered in order to use the space in the truck efficiently. (Du, Wang & Lu 2006, 565)

These above mentioned transportation networks are commonly used especially in automotive industry, where the volumes and pick-up schedules are varying all the time. The following chapter will cover the milk-run logistics concept and its benefits and vulnerabilities in a deeper sense.

5 MILK-RUN LOGISTICS FOR AUTOMOTIVE INDUSTRY

Milk-run logistics is a traditional concept with its historical background in the dairy industry. The name comes from the West, where a milkman would drive special routes with his dray and stopped in front of the doors of the customers' houses, delivered milk bottles to them and collected empty bottles at the same time. (Hosseini et al. 2014, p. 1)

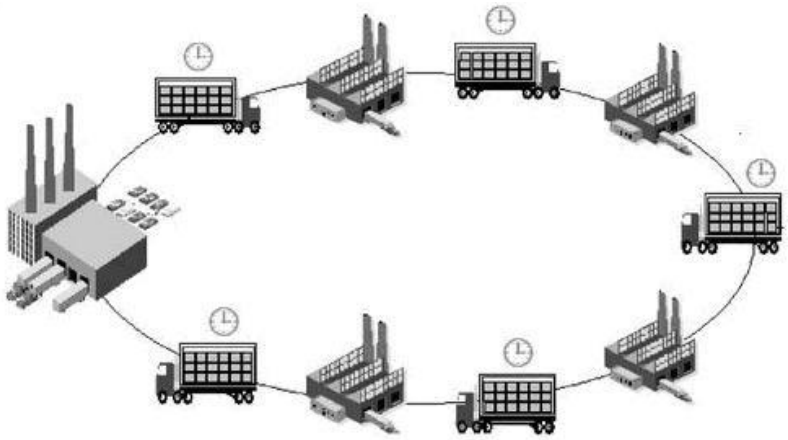

Figure 8. A milk-run route (Hitachi Transport System 2013)

The milk-run concept exists globally and the automobile industry is the most important client for a milk-run logistics system. Milk-run logistics concept can provide the best utilization when the suppliers which have volumes of less than a truck load and are located close to each other on the same route. Those suppliers should use milk-run logistics in order to save inventory holding costs and ensure faster deliveries to customers. (Hosseini et al. 2014, p. 1)

According to Brar and Saini (2011), "Milk-Run logistics is becoming one of the standard systems of an overseas version of JIT distribution."

As the figure below shows, there are two kinds of approaches which are a plant-hub approach and a milk-run. In the plant-hub approach, there are full truck loads arriving to the plant from each supplier. In a milk-run, one truck collects less than a truckload amounts from each supplier and after the last stop the truck will continue to the manufacturing plant. The milk-run approach is more sophisticated

transportation method compared to the plant-hub approach, because it requires a more accurate planning process on how to match suppliers, routes and volumes to the same milk-run. (Baudin 2004, 132)

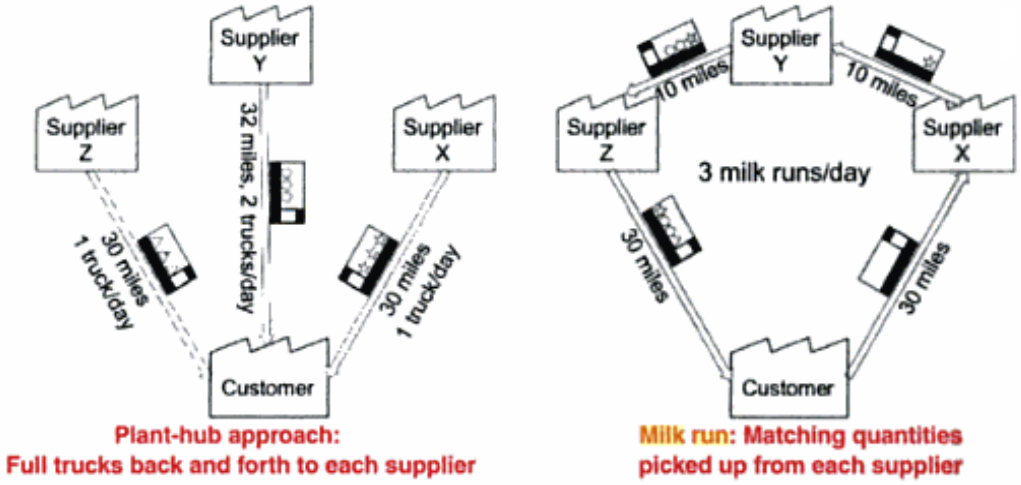

Figure 9. An example of a plant-hub approach and a Milk run approach (Baudin 2004, 132)

It can be argued that plant-hub approach is not fulfilled by "just-in-time" – philosophy. The inventory level in the manufacturer's warehouse is fluctuating all the time when the full truckloads from particular suppliers are arriving. The Just-in-time principle is linked to the milk-runs, where the truckload consists of the collection of goods from several suppliers. (Baudin 2004, 132)

5.1 The benefits of milk-run logistics

There are a lot of benefits when implementing the milk-run logistics concept. Probably the most important advantage of the milk-run is the reduction of travel distance and fuel consumption.

Nowadays, customers value ecological products and the awareness that the firm is using an ecological transportation method creates a positive impact to the customers. One of the benefits in Milk-run logistics is that it is an ecological transportation option. There have been some researches confirming that milk-run

logistics is an environmental-friendly choice when considering CO2 emissions, for instance. The milk-run logistics reduces the number of trucks on the road so it is a favorable choice when it comes to traffic conditions and congestions. (Brar & Saini 2011, 1)

According to Baudin (2004, 133) the milk-run logistics concept increases efficiency: After unloading, the empty pallets and containers are delivered to the suppliers on the way back.

As the purpose of the milk-run is to operate according to the Just-in-time philosophy, it is aiming to achieve almost zero inventory in the manufacturing plant. The picture below shows the stability of inventory level when practicing the milk-run. As a comparison, the picture shows the inventory level in "plant as a hub" approach, which seems to have an unstable inventory level. (Sople 2007, 89)

Figure 10. Inventory levels. (Baudin 2004, 134)

5.2 Vehicle routing problem and Milk-run planning

A big part of logistics systems deal with the management of logistics functions to serve warehouses, customers and/or retailers. To monitor the costs of these functions, vehicle routing problems (VRP) exist to help with the questions regarding the vehicle loading. (Simchi-Levi, Chen, Bramel 2005, 217)

According to Brar and Saini (2011), "The Milk-Run vehicle routing problem is an extended variation of the vehicle routing problem".

Usually, while planning milk-run schedules, there is a use of heuristics or meta-heuristics approaches like Genetic Algorithms (GA). These mathematical models help to find the most optimal solutions to vehicle routing problems. (Sadjadi, Jafari & Amini 2008, 2)

There are several different route optimization software which process algorithms. For example, The Arc Logistics is one kind of software solution for route planning favored by Finnish companies.

Milk-run planning can be done "manually", too. However, it requires a lot of time and work and it is based on the planner's own observations about optimal routes. When planning milk-run routes, the information about supply volumes and other details such as location details are needed. When these factors are combined among three or four potential suppliers, one milk-run trip has just been prepared. After the suppliers are combined with the most optimal pairs, the suppliers are informed about the pick-up schedules and volumes. This will lead to a negotiation with the suppliers and 3PL and if necessary, changes to the milk-run plan will be done. (Brar & Saini 2011)

Below is an example of a travelling salesman problem (TSP), which is based on the vehicle routing problem. The idea of this function is that the salesman starts his trip from the city 1. The aim of the picture on the left side is that the salesman travels to the cities in this order 1 → 4 → 2 → 5 → 6 → 3 → 1. The total kilometers are 62. In the picture on the right side, the salesman changes the order of the cities. The salesman is now travelling in the following order: 1 → 2 → 5 → 4 → 6 → 3 → 1. The total travel distance is now 48 km. The idea of travelling salesman problem is to find the most optimal route solutions. (Bin Muhammad)

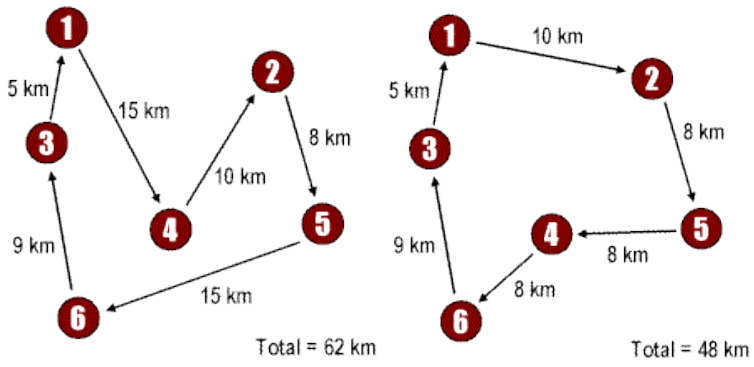

Figure 11. Travelling salesman problem (Bin Muhammad)

6 THE RESEARCH PROCESS

6.1 Data Collection

Primary data

Sometimes, the researcher needs to collect the empirical data due to the inappropriateness or lack of secondary data. When the researchers collect the data by themselves, it is called primary data. (Ghauri & Grønhaug 2002, 102)

According to Ghauri & Grønhaug (2002, 102), the way to collect the primary data depends on the research design and problem.

The methods to collect primary data are, for instance, interviewing, conducting surveys or questionnaires, other written material such as stories and diaries created by research participants, observations, drawings, and acting a drama etc. (Eriksson & Kovalainen 2008, 77)

As the action research includes a lot of interaction with the members in the organization, the primary data in this study was mainly collected by interviewing the members of the staff. Also, a questionnaire was prepared for the transport manager.

Secondary data

Secondary data, which is empirical data and exists already, is collected by someone else than the author. In order to support the actual research, it is necessary to search previous researches or publications about the topic. (Eriksson & Kovalainen 2008, 77)

According to Ghauri & Grønhaug (2002, 100-101), there are lots of different sources of secondary data. If the business research is conducted for a company, there is often access to their internal data sources, which often include data about suppliers, customers, employees, marketing plans and efforts, and even competitors, for instance. When reading internal data sources, the research ethics and confidentiality should not be forgotten.

The external data sources are, for example, published books and academic, professional and popular journal articles. These data sources are available in the libraries and in Internet. (Ghauri & Grønhaug 2002, 101)

In this study, internal data sources have been the major source of data when creating the milk-run transportation plan. The whole data in the milk-run plan includes the details and volumes of the suppliers so without internal data sources it would have been impossible to prepare the milk-run transportation plan.

Furthermore, Internet has been the major source of secondary data to help understanding the milk-run logistics concept. For example, E-books and E-journals in Google Scholars and Nelli-portal were the author's main external data sources. Some books in the library helped to define the main concepts. Also, the author did read a few theses about the same topic to get some perspective how to write a thesis.

6.2 Research ethics

It is necessary to consider research ethics as the author conducted a working-life related study for a company. To refer to this study, the author has respected confidentiality, which plays a major role in this study.

According to Eriksson & Kovalainen (2008, 62-63), ethics is usually connected to the mindset of what is right and wrong. However, it can be said that ethics is always somehow present in our everyday life because there are lots of written and unwritten laws and regulations which are steering us.

Plagiarism is another serious viewpoint of the research ethics. Plagiarism means that the author is copying someone else's research ideas, work, inventions, publications and written texts and using and mentioning them as her own. (Eriksson & Kovalainen 2008, 75)

When conducting a business research, the matters which go beyond the ethics should be considered. When doing a research, ethics needs to be considered during the whole process. When it comes to the ethical principles, informing, fraud, causing harm and risk are strictly forbidden. It is important to respect others in the

organization and treat them as ends instead of treating them as means. Also, the researcher has to be unbiased even if the results would not be agreeable. (Eriksson & Kovalainen 2008, 62)

RESEARCH CYCLES

In order find answers to the research questions, this research has been divided into four cycles. Each step in the cycle has been thoroughly explained in order to describe the whole process to the reader as accurately as possible. After each development discussion, there is a movement to the next cycle which means that the researcher takes the action to improve.

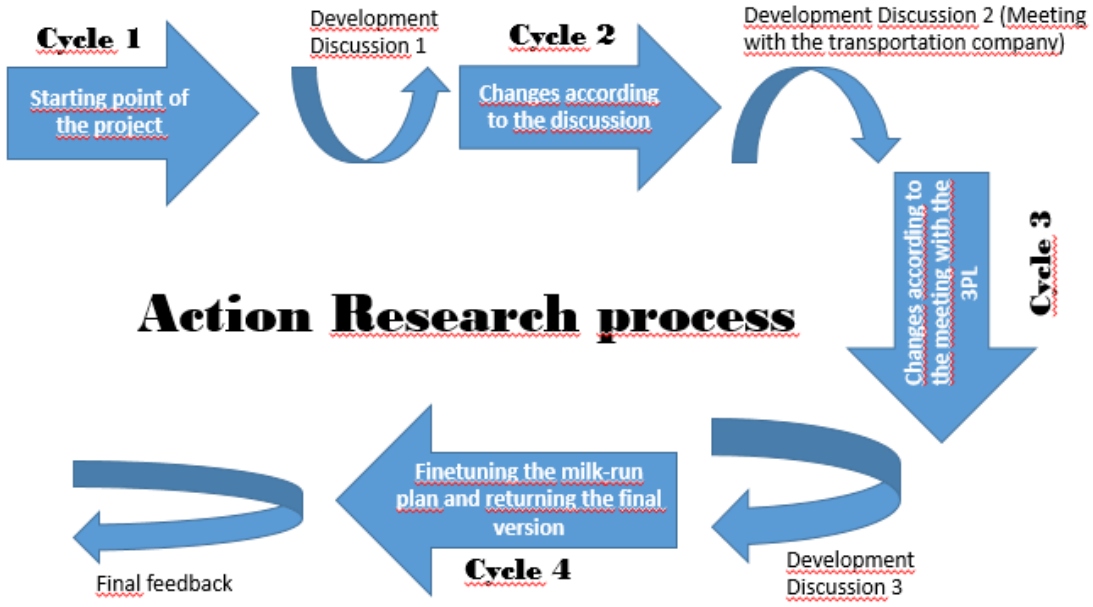

Figure 12. The research process.

6.3 Cycle 1 – Identifying the problem and idealizing how to start the project

The whole research started when the author started her job as a summer trainee in Valmet Automotive. The author was given a task in the inbound logistics of Eastern-

European car-part suppliers –project, as there were some problems in the inbound logistics concept from that area.

Valmet Automotive is outsourcing its logistics, and the problem which was introduced to the author was that the current inbound logistics flow did not function according to the milk-run expectations.

The main problem in the inbound logistics was that a "hub-approach" was dominating. This means, that the car-parts in the Eastern-European area were transported straight to the nearest consolidation centers and consequently, there were a mixed amount of several different car-parts in the consolidation centers, waiting for the pick-ups. After loading car-parts in the supplier a, the truck continued the trip straight to the hub, not even on the route, just to take something to fill the empty space in the trucks. Consequently, half empty trucks arrived to the manufacturing plant every day. This meant, that there were a lot of unnecessary costs because even one empty cubic meter in a trailer costs thousands of Euros annually. Thus, the aim of this study was to introduce a milk-run logistics concept to Valmet Automotive so that the 3rd party logistics provider would implement the concept.

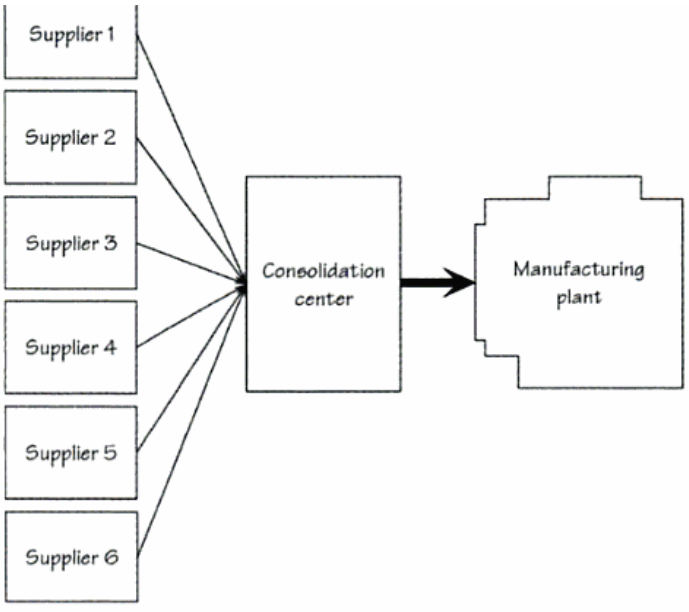

Figure 13. The previous inbound logistics operations. (Baudin 2004, 161)

Due to the lack of previous experience in the field of logistics planning, there was a need to study the company's inbound logistics flows and functions and learn the new terms. At the beginning of the project, the transport manager at Valmet Automotive introduced the inbound logistics problem, the concept of the Milk-run logistics and why it should be implemented in the inbound logistics flow in the area of Eastern-European suppliers.

Action 1: The first concrete task was to learn how to prepare a milk-run transportation plan in a logical way. In order to be able to start creating the milk-run transportation plan, there was a need to search secondary data about inbound logistics processes and milk-run logistics concept in general. At the beginning of the project the name "milk-run" was completely an unknown definition so there were lots of sources to read.

To understand the core benefits of the milk-run, the author analyzed tens of inbound trailer pictures daily to see how much there is empty space in the truck. Little by little, it became easier to understand why the milk-run logistics concept would be an excellent solution to reduce transportation costs: there were a lot of empty space in the trailers so it made sense that by combining different volumes and different suppliers in the same route, the empty spaces could be utilized with another suppliers' cargo.

One of the crucial factor which helped to proceed in the study was a constant interaction with the project members. For example, the following questions were discussed before starting the practical work:

1. Why should the milk-run logistics concept be adapted to the Eastern-European supplier delivery?
2. Which factors made the previous inbound logistics functions problematic?
3. What is the expectation of the cost reductions after implementing the milk-run logistics concept?
4. What are the other benefits for the company after the implementation of the milk-run transportation plan?
5. How does the increasing amount of volumes affect to the transportation capacity?

After identifying the problem and reading background information about the topic, the preparation of the practical working basis started. All the details of the suppliers (name of the supplier, location, pick-ups per week, volumes per week etc.) were collected and put into an own map in Google Maps. Then, the combining of the potential suppliers on the same route started.

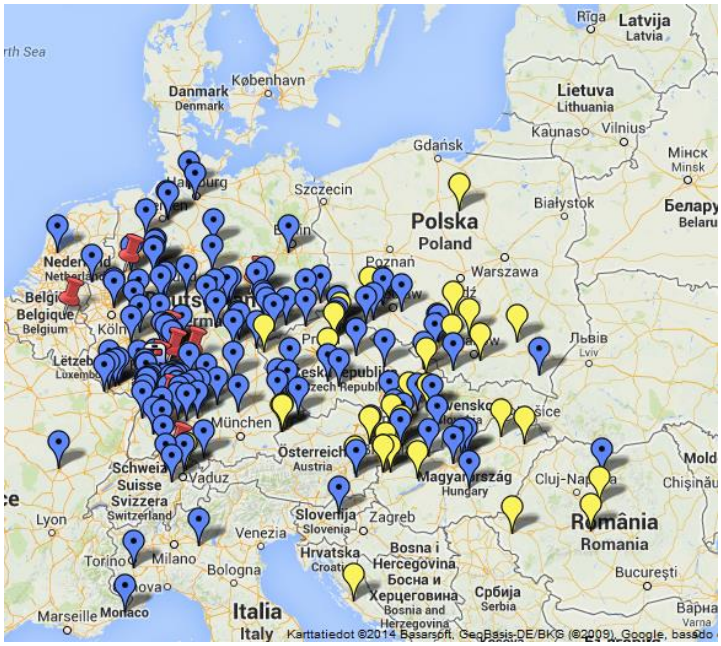

Figure 14. An illustrative example of the supplier locations -map

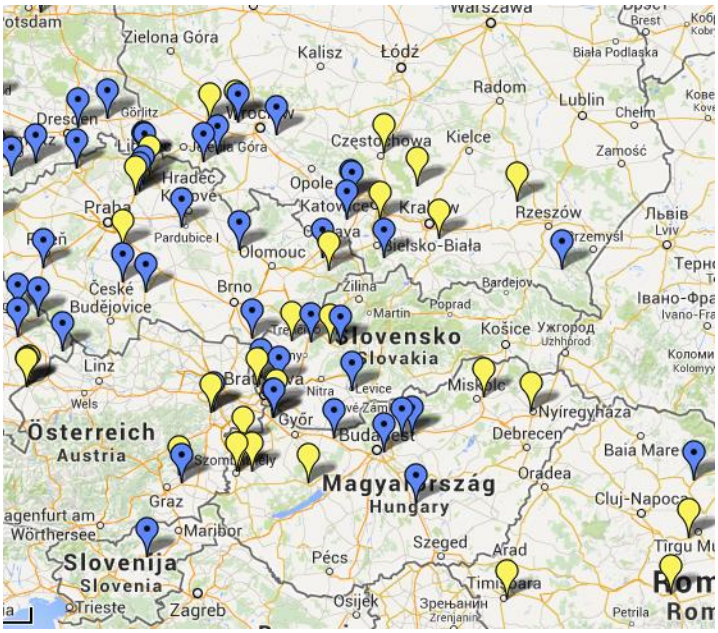

Figure 15. An illustrative example of the supplier locations –map.

As soon as the Google Maps –mapping was done, the actual milk-run transportation draft was prepared. The first draft included the name of the supplier, country of the supplier, the zip code of loading, volumes per week, number of pick-ups per week, number of stops in the milk-run route, total volume in the truck, and the distance between each milk-run stop. The author attached the pictures of the maps to demonstrate the milk-run.

	Supplier	Country	Loading	m3 / week	Extra stop	m3 / truck	Distance between
A		Hungary		1 x 85	0	85	
B		Slovakia		1 x 114	1	14	(1 x 100 m3 / week + sur
					TOTAL:	99	A-B ca. 125 km
Trip 1	**Supplier**	**Country**	**Loading**	**m3 / week**	**Extra stop**	**m3 / truck**	**Distance between**
A		Slovenia		2 x 112	0	56	(2 x 56 m3 / week)
B		Austria		1 x 12	1	12	(1 x 12 m3 / week)
C		Austria		1 x 60	2	30	2 x 30 m3 / week)
					TOTAL:	98	
Trip 2							
A		Slovenia		2 x 112	0	56	(2 x 56 m3 / week)
B		Hungary		1 x 12	1	12	
C		Austria		1 x 60	2	30	
					TOTAL:	98	

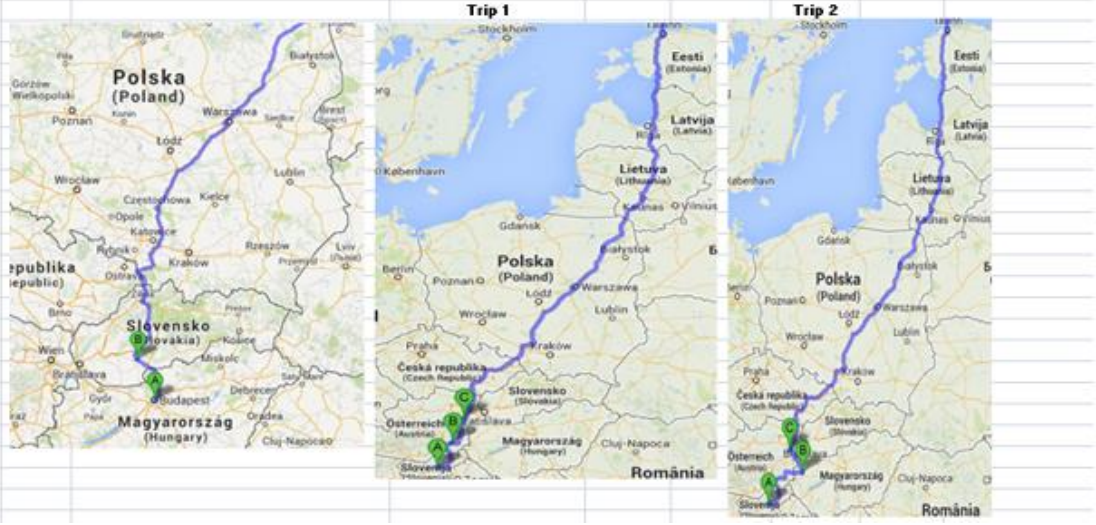

Figure 16. An illustrative example of the first Milk-run draft

Development Discussion 1: The development discussion 1 was held after finishing the first draft of the milk-run transportation plan. The participants in the first development discussion were the Transport Manager and the Supply Chain Director at Valmet Automotive. They assessed the first milk-run draft created by the author and the feedback was constructive. However, there were some extra factors which had to be considered. The check of the milk-run draft indicated that the author had understood the milk-run logistics concept. There were some new ideas about how

the milk-run plan could be improved. The changes and admixtures were agreed to be made to increase the validity of the plan.

6.4 Cycle 2 – Developing the plan according to the first discussion

The first development discussion ended up with a conclusion that the agreed inclusions would be prepared. Thus, an excel tool, which calculates loading times and driver's rest times, was created to increase the validity of the plan. The next step of the research was to make some improvements along the excel tool and to prepare a presentation for the upcoming development discussion which was about to be held together with the transport manager of Valmet Automotive and the 3PL provider.

				Distance (A-B)	
Option A	Loading time	Supplier A	m3 / pickup	KM	Time
Trip 1	30.6.2014 8:00	[redacted]	56	158	2:38
				Distance (B-C/Tallinn)	
	Loading time	Supplier B	m3 / pickup	KM	Time
	30.6.2014 12:38	[redacted]	12	129	2:09
				Distance (C-D/Tallinn)	
	Loading time	Supplier C	m3 / pickup	KM	Time
	30.6.2014 16:47	[redacted]	30	1688	63:23
		Distance (HKI - UKI)		Duration (HKI - UKI)	
	Tallinn harbour	Helsinki	KM	Time	Valmet Automotive
	3.7.2014 10:10	3.7.2014 18:10	241	4:01	3.7.2014 22:11
	Total Transport time (d)	Driving time	Km driven		
	3,6	36:56	2216		

Figure 17. An excel-tool to calculate loading times, travel-times and driver's rest-breaks.

Action 2: As the third party logistics provider is operating the company's Eastern-European inbound logistics, the meeting was arranged with them and the author's task was to introduce the accomplishment to 3PL during the upcoming meeting. Along with the brainstorming and refining the plan, the author started to prepare for the meeting as her task was to convince why the milk-run transportation plan, which is executed according to the milk-run logistics concept, should be implemented.

Development Discussion 2: The second development discussion was held together with the transport manager of Valmet Automotive and two managers from the 3PL company. During the discussion, each of the milk-run supplier combinations were discussed in detail and the necessary changes were agreed to be made. The aim of the meeting was to face the realities and make changes to the milk-run transportation plan according to the factors which had to be considered.

The main objectives of the development discussion were to:

A. introduce the Milk-run logistics concept and its' advantages to the 3PL provider so that both the company and 3PL will agree to implement the new concept
B. introduce the milk-run transportation plan to show how the milk-run can be adapted in practice

As a result of the second development discussion, the concept was agreed by both parties. There were a couple of milk-run combinations which had to be changed but all in all, the plan seemed to be feasible.

6.5 Cycle 3 – Changes to the Milk-Run plan according to the meeting with the 3PL

Action 3: The changes, which were agreed to be made during the second development discussion, were made at this stage. For example, the amount of cubic meters in the milk-run trips were reduced in order to make sure that the whole cargo will fit to the trucks. Also, one supplier was removed from the milk-run list because it was not suitable for combined milk-run trips due to the high volumes.

Development Discussion 3: The third developmental discussion was held together with the transport manager of the company and one employee in the logistics department who is working as a transport planner at Valmet Automotive. The enablers and challengers of the milk-run transportation plan were discussed during the meeting. One issue appeared in the company's computer system: the system calculates the cubic meters of each supplier in a way which is not ideal for the milk-

run logistics concept. However, the feedback about this challenge was that the system must be changed, not the milk-run plan because the idea of this project is to find optimal solutions in inbound logistics and if the system is not fulfilling the needs, it should be changed. The third developmental discussion did not include anything new to add to the transportation plan, but the author wanted to fine-tune it before returning the final version.

6.6 Cycle 4 – Returning the final milk-run transportation plan

The final fine-tuning and small changes were made and sent to the transport manager for assessing and giving the final feedback.

The final milk-run transportation plan includes the name of the supplier, the country and the zip code, the number of the milk-run stops, Volumes per truck, delivery times per week, the amount of cubic meters during the weekdays and the estimated time of departures and arrivals.

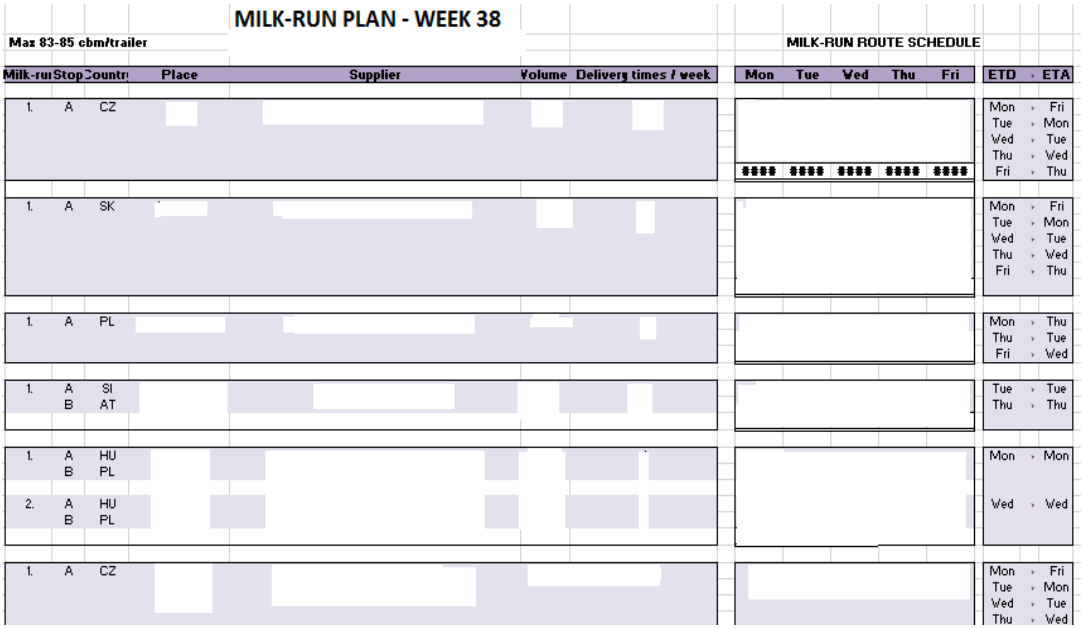

Figure 18. An illustrative example of the final milk-run plan.

The last step in this research was the final feedback of the milk-run transportation plan given by the transport manager. The final feedback will be covered in the "results" -part in this report.

7 RESULTS

The main research question was to introduce a milk-run based inbound logistics concept to Valmet Automotive by preparing a milk-run transportation plan.

As a result of this research, the Milk-run logistics concept has been introduced to the company by preparing a milk-run transportation plan concerning the inbound logistics of Eastern-European car-part suppliers.

The sub-objective was to consider the enablers and challengers when implementing the milk-run logistics concept to the company's inbound logistics functions. In order to demonstrate this question, the author prepared a SWOT-analysis in order to look at the concept itself and the final Milk-run plan from different aspect.

7.1 A SWOT-Analysis

To brainstorm the enablers and challengers of the final milk-run transportation plan, the SWOT-analysis seemed to be the best tool to demonstrate the different aspects. This SWOT-analysis states the strengths, weaknesses, opportunities and threats of the final milk-run transportation plan.

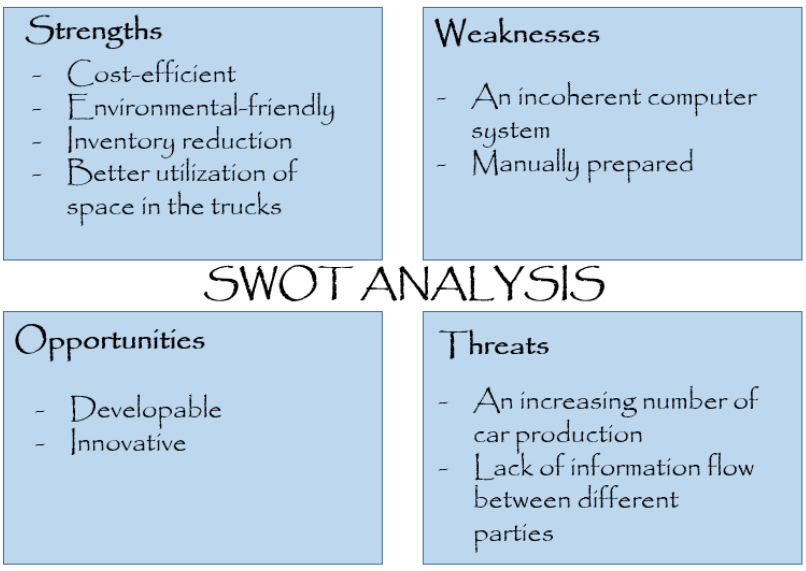

Figure 19. A SWOT Analysis to demonstrate different perspectives of the milk-run plan

As the figure shows, the milk-run transportation plan has many strengths. It is cost-efficient, environmental-friendly, keeps almost zero inventories, and there is a better utilization of space in the trucks because several suppliers are able to load to the same truck. When implementing the milk-run concept and being able to maintain it, these factors in the long-run will bear a big fruit for the company. According to the transport manager's latest information, the implementation of the milk-run concept has already reduced operational logistics costs 6 %. The future cost-reduction is expected to be about 3 % as a result of extra planning and intensified operations.

The weakness, which stands out from the milk-run plan is that it is prepared manually. It is not in synergy with the company's computer system which calculates the supplier volumes in a different way. The reason why the author did not prepare the milk-run transportation plan according to the way how the system does, is because the idea of the milk-run planning is to find the most optimal routes. The way how the system calculates the volumes of the suppliers is not logical when it comes to the planning of optimal milk-run routes.

Luckily, the opportunities are able to compensate the weaknesses. The identified opportunity is that the computer system of the company can be changed in a way that it will be in synergy with the milk-run logistics concept. The enabler for this is that the managers of the logistics department seemed to be innovative-minded and agreed that the system needs to be changed if it is not optimal for the milk-run – concept. Also, if necessarily needed, the company is able to acquire an optimization software which makes it easier and less time consuming to plan new milk-run routes daily.

The main threat, which may arise in the milk-run, is that the car production is increasing every day. This means that the supplier volumes are changing rapidly and thus there must be a constant monitoring of different milk-run opportunities. If one milk-run has been sufficient in one week, it may not be suitable anymore during the following week because the volumes are changing and thus there is probably no space in the truck anymore. Another threat is that if there is a lack of information flow between different parties in the supply chain, there is no way that the milk-run plan would be successful. Especially, it is necessary that the information flow between the manufacturer, the suppliers and the 3PL is continuous.

7.2 The final feedback

To assess the results more accurately, the final feedback was given by the transport manager of Valmet Automotive.

According to the transport manager, the results were good when considering the objectives which were agreed at the beginning of the project. After all, the 3PL provider accepted the milk-run concept, too, and is now implementing the concept to their inbound logistics functions in the Eastern-European supplier routes. However, there are still many areas of development, but the basis for the milk-run concept exists now.

The transport manager highlighted that the author had raised a good viewpoint about the environmental aspect of the milk-run transportation plan. Also, it was advantageous that there were observing configurations during the research process.

According to the transport manager, the opportunity and strength of the final milk-run plan is that it is potential and advantageous when it comes to both the 3PL provider and the company. Also, it was good that the "researcher" was an outsider because then the author did not take a stance on the current model and how the inbound logistics flow has always been functioning.

Information flow is a crucial factor when doing developmental works. The transport manager points out that if there would have been more interaction between all of the concerned members in the organization, it would have made the research process easier.

To sum up, the feedback of the milk-run transport plan during the process was positive: the main principles are appearing in the plan and there are optimal solutions which make sense in the perspective of cost-reduction, more effective inbound logistics flow and environmental-friendliness. However, the concept is going to be developed further, and the transport manager says that the changes concerning how to change the system to a more optimal way are covered in the next year's development plan.

7.3 Reliability and validity

Reliability and validity are the two important tools to measure whether the scientific statements of the studied phenomena are reliable. However, according to Herbst & Coldwell (2004, 17) “validity is not possible without reliability”.

There are two aspects how to consider the reliability and validity of the research. Firstly, there needs to be discussion whether the research method is appropriate to answer the research questions or not. Secondly, the conclusions of the results need to be considered in the perspective of validity and reliability. (Hiltunen 2009)

When the measurement of the phenomena is in synergy with the coherent results, it is called reliability. Reliability is linked to “repeatability”, which means that by repeating the measuring of phenomena it will provide similar results over and over again. (Wilson 2010, 116)

Validity consists of the internal and external validity. Internal validity means the synergy between the hypotheses and the available evidence. That is to say, validity is measuring whether the data has an effect on the researched objective or not. External validity means that the findings can be generalized to other similar contexts and situations. (Herbst & Coldwell, 2004, 17)

When considering this research, reliability needs to be considered in different aspects. As the milk-run transportation plan is created according to the verbal instructions and the support of the theory in several books, implementing something in practice in world-life situation means something else than what the book says about the topic. Each company has its own ways of operating and thus the practical part needs to be tailored to the company’s specific needs. Thus, when the author has created the milk-run plan, of course reliable data sources have been utilized to obey the principle of the milk-run logistics concept. The end result is that the milk-run plan has been tailored to the company according to its needs. It can be said that if someone else than the author will repeat the preparation of the milk-run transportation plan exactly in the same way, the results may be quite similar. However, there may be some differences of the choices because there were several optimal route solutions for particular suppliers.

When it comes to the validity of the study, it is obvious that the data has an effect on the researched objective. To repeat, the objective of this study was to introduce the milk-run logistics concept. Thus, the milk-run plan has an effect on the objective, because it is a concrete hypothesis. However, it depends on the reader how the validity is valued. For example, someone thinks that mathematical algorithms are more of value and increase validity. Thus, the validity could be increased by preparing the milk-run transportation plan by an optimization model, which is based on mathematical algorithms.

It can be argued that if there would have been an access to a computer-based vehicle optimization software, the results could have been more reliable. However, the objective of the research was to introduce a milk-run based transportation method for the company, it was easier for the author to introduce a concept which has been gone through thoroughly, and not by letting the computer to make all the "brainstorming" and optimization calculations. Also, if the plan would have been prepared by an optimization software, still there would have been differences between the plan and the company's computer system.

8 DISCUSSION

8.1 Conclusions

Business is changing from local to global and naturally, it shows up strongly in the supply chain functions of the companies. This means that the old strategies which the companies are using may not be as efficient as previously.

Competitiveness is the most crucial factor for firms to succeed. A competitive advantage, which is the main purpose of a value chain, can be reached by a value-advantage or a cost-advantage. The cost-advantage is quite easy to reach when the focus is on the logistics part of the supply chain. For some reason, the companies often forget the inbound logistics functions because the main focus is on the distribution of the final products. However, inbound logistics is the basis for the

whole upcoming process of manufacturing, so inbound logistics planning is a vital action for a company which wants to succeed.

The main objective of this study was to introduce a milk-run based transportation method which will improve the inbound logistics flow at Valmet Automotive. As a result of this research, the milk-run logistics concept was introduced by preparing a milk-run transportation plan for Valmet Automotive. The sub-objective was to consider the enablers and challengers which may appear while implementing the milk-run plan.

The problem at the beginning of the project was that the transportation network of the Eastern-European suppliers was too much “hub-oriented”, which was troublesome when it comes to the efficient inbound logistics flow of the car-parts. Previously, the car-parts were delivered from the suppliers to the nearest consolidation centers which were not always even on the route. When the truck arrived to the hub which was full of mixed cargo, everything was just loaded to fill the empty space in the truck. Consequently, the inventory levels were fluctuating and there were a lot of mixed car-parts unloaded. The way of delivery was not optimal when it comes to the route options.

When considering the milk-run concept, it has many benefits when implementing it: for example, the advantages for the company will be majorly the cost-reduction in the long-run. As mentioned earlier, the costs have already reduced by 6 %.

The sub-objective, which was to consider the enablers and challengers when implementing the milk-run transportation plan, was also achieved. There were a lot of different perspectives, both positive and negative. However, the results were mainly positive and the negative ideas can be changed into positive ones. The biggest challenge which was identified is that there is an increasing number of cars manufactured and it means that the supplier volumes are changing rapidly. In order to overcome the challenge, there is a need of constant planning of milk-run supplier combinations. This means that the Milk-run route schedule needs to be updated in an operational level, i.e. every day. The volumes are changing daily so there needs to be a routine to search for new supplier combinations all the time. One suggestion is that if the aim of the milk-run plan is to ensure the best possible benefit, it would

save time and money if a company would acquire an optimization software which will combine the most optimal supplier pairs in the operational level. Also, if the author's milk-run transportation plan is implemented, there is a need to change the company's software system to reach the synergy between the plan and the software.

Another challenger of the milk-run plan is that the company's computer system, which monitors the inbound logistics flow (unloading schedules etc.) calculates the supplier volumes in a way which is not optimal when considering the milk-run logistics concept.

To conclude, the basis for the implementation of the milk-run logistics concept exists now and the challenges will be considered when developing the milk-run concept in the company's inbound logistics operations.

8.2 Suggestions for further studies

Logistics-related studies may give lots of research ideas and perspectives because that part of the supply chain is so complex and thus can be researched over and over again. Very few people know how supply chains work "correctly", so there are always interesting areas to explore.

As the inbound logistics flow is one key factor for the firms to become cost-efficient and add value to their products, it is an advantage for firms to focus on the inbound logistics functions.

Further studies concerning this study could be, for example, studies about the cost-efficiency and environmental-friendliness after implementing the milk-run transportation plan. Calculations about the cost reductions in the long-run could be very valuable information for the company when the milk-run transportation plan has been in use for a while. Also, the studies about the ecological aspect of the milk-run logistics concept could be an interesting and valuable perspective, as the environmental factors are now discussed more than ever. Other suggested topics to continue this research could be related to the weaknesses and threats which were mentioned in the SWOT-analysis. For example, how to deal with the increasing

production level in the milk-run planning and how to ensure that the information flow does not become broken. Also, there could be a comparison of the milk-run transportation plans which are prepared both manually and by an optimization software to see how much they differ and which one is more suitable to adapt in practice.

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