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MANAGING RISK IN SUPPLY CHAIN

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<p>Nimeke Managing Risk in Supply Chain</p> <p>Toimeksiantaja Medisize Oy</p>	
<p>Tiivistelmä</p> <p>Opinnäytetyön aiheena oli tarkastella riskien hallintaa toimittajaketjun hallinnassa. Työssä kartoitettiin erityyppisiä riskejä sekä analysoitiin niiden vaikuttavuutta teollisuuden ostotoiminnassa. Työn tarkoituksena oli myös parantaa tekijän oman työn tekemisen valmiuksia, sekä tuoda toimeksiantajalle uusia näkökulmia toimittajaketjun johtamiseen</p> <p>Työssä tutustuttiin erilaisiin riskinhallinta tekniikoihin, joita on vuosien varrella esitelty erilaisissa lähteissä. Työssä tehtiin toimeksiantavan yrityksen ja sen asiakkaiden parissa teemahaastattelututkimus, jossa kartoitettiin nyt yleisesti käytössä olevia tekniikoita, työkaluja ja näkemyksiä. Tiedonhankinnan menetelminä käytettiin dokumenttianalyysiä ja teemahaastattelututkimusta.</p>	
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Abstract <p>In this master thesis the focus was to study risk management in supply chain management. During the work different types of risks were studied and how they affect purchasing in industry. The purpose of the work was also to enhance the writer's ability to do his own daily work and to bring new views to his employer for managing a supply chain.</p> <p>In this work different techniques which have been introduced in the industry were reviewed. During the work, an interview survey was made among the people who are working within a purchasing organisation. The purpose of the theme interview survey was to reflect the techniques, tools and visions that those people are using currently. The primary source of information was available theory from literature and the secondary source was the theme interview survey.</p>	
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1 Introduction

Managing a risk is an essential task in any business activity. When considering risk management in manufacturing industry, a supply chain risk management has wide impact for all business areas. Failure to properly manage or neglect risks that are involved in the all so important supply chain, can lead to huge impact for business continuity. Dependency of the suppliers is one pitfall that is not always taken into consideration when planning a project. Some of the project in my industry area have nearly 50% value laying on the purchased components. Annual spending is very significant, and by managing the supply chain and risks right, can lead to significant savings.

Medical device industry is strictly regulated by different authorities which brings some additional challenges to supply chain management. There are guidelines and regulations that need to be followed, and that makes the work even more important. Proper understanding of the power of authority is essential to keep in mind when making supply chain decisions.

In order to get deep understanding of the risk management in supply chain managing, it is essential to do wide research of the written literature. Another research method that was used to get hands-on information, is an interview survey among persons that work in the industry.

1.1 Background

In 2013 a new position was introduced to the commissioning company. That position requires technical and financial understanding of the business. An important factor is also to understand the risks that are involved in the supplier selection and therefore this type of master thesis was seen as appropriate.

Development in the medical device industry has led to more complex and difficult projects to manage. New products, already recently introduced to the market, are integrating heavily electronics and high-tech technology to produce safer, more reliable and more user friendly devices for consumers. Growing markets in Asia are pushing device manufactures to make devices to meet the new type of demand. That demand is for devices that are specifically designed for the market they are sold to. That can create multiple variants that are not sharing the same components. This leads to expanding supply base and even more focus for the risk management.

Components are sourced with global supply base. This is because the needed component volumes are too high for most domestic suppliers and also accuracy demand may also be too difficult to handle. When operating globally, one has to carefully consider different types of risks that are present. Risk management cannot be emphasized ever too much. Multiple examples from the past and from different industry sectors have proven that even the large multinational companies will face the effects when risk realizes.

In this master thesis I first made a literature examination and reflected the material to the industry sector this work is done. In the second phase theme survey was conducted among the people that have worked for a long time with these issues. Lastly in a summary section comparison was made between phase one and phase two.

1.2 Framework

This master thesis focuses only on the risk management on supply chain management. Supply chain management is not included more than is necessary. This master thesis does not take into account other risk management areas since they are not essential to the work.

2 Abbreviations

COGS = Cost of goods sold

ERP = Enterprise resource planning

FMEA = Failure mode and effect analysis

TCO = Total cost of ownership

TPM = Toyota production system

SKU = Stock keeping unit

3 Goal of the thesis

The goal of this thesis was to find out what theories are written around risk management and to compare those to the opinions and experiences of the people who work with these issues. The aim was to find out if there are risks that are most obvious to threaten the stability of the supply chain. Risks were also ranked based on their influence. Furthermore, this work will enhance the ability of the writer to develop his professionalism around supply chain management. Finally, this work hopefully gives to the commissioning company added value when developing purchasing processes.

4 Leadership in supply chain management

The main tasks in leadership can be defined as to inspire and to motivate manager to plan, organize and coordinate. (The Wall Street Journal 2015, 1). In the supply chain management, leadership is found at all levels of the work. True industry leaders find that the central role in the supply chain is to be an integrator. All six main areas have to be mastered and owned, that is, supply chain management, product development, demand planning, supply planning, sourcing & procurement, manufacturing and logistics & distribution. Otherwise, one does not have a complete vision of the purchasing function and it cannot be lead properly. (Deloitte LLC, 2004)

Leadership in supply chain is demonstrated, if the supply chain is resilient: that means the ability to deliver predictable results, even with volatility in the demand. Another visible indication of the presence of leadership is that best practices are not only adapted, but new and innovative ones are created. (Hofman 2011, 10-11)

Leadership can be also translated into financials. When a purchasing organization sees itself as one of industry leaders in the supply chain management, they

can see their supply chains from their customers' perspective. Key values in their supply chain management are for example breakthrough products, distinctive services, and unique customer experiences. All of the systems linked in their supply chain like processes, organization and mindset mean they can create top-line growth while improving bottom-line performance. (PWC 2013, 4)

It is essential to show leadership at personal level, as that will either make your suppliers to either trust you or not. That type of leadership either exists, or not, as it cannot be bought. By demonstrating a strong attention to the detail, goal setting capabilities, motivation skills and inspiration, one can be taken as leader in this function as well.

When leadership in supply chain management is shown, the risk management will be also more effective. When focus and mindset is correct, the effect on the organization's financials and on the stability of the business is more secure.

5 Supply chain

Sunil Chopra et al. define supply chain in their book *Supply Chain Management, Strategy, Planning and Operation* as a group of activities of all parties involved, fulfilling a customer request. This includes all manufacturers and suppliers and activities included in the transport of the goods, warehousing, retailers and even the customer. All functions are included, that is, product development, marketing, operations, distribution channels, finance and customer service. As a dynamic function that has constant information flow, it also incorporates capital movement between different stages. (Chopra & Meindl 2004, 4.)

The objective of the supply chain activities is to maximize the value of the operation activities. That can be measured from the value of the product towards the customer deducted costs that have been spent for all manufacturing activities, including the supply chain. (Chopra & Meindl 2004, 6.)

As I look into the position where I have to master the supply chain in pre-production phase, the above mentioned statements are valid. In my work I interact closely with internal and external research and development teams to ensure that I have the possibility to say if there are concerns for me to fulfill the production requirements due to design choices. Finance is very important in all phases during pre-production. My job is to negotiate and select solutions that have the lowest total cost of ownership (TCO) possible. Customer service has to be kept in mind all the time, but at the same time it must be remembered that in the end, it has to be business to us. Constant information flow can sometimes feel even overwhelming, there is a great amount of information daily coming from the customer that has to be distributed to suppliers and internal stakeholders and also vice versa. Maximizing the value of my work has to be of course the cornerstone of my work. I have to show internally and externally that my work will be considered as added value all the time.

5.1 Sourcing activities in the supply chain management

Purchasing, or procurement, is a combination of processes by which companies acquire raw materials, components, products, services among other thing from supplier to produce their own services. (Chopra & Meindl 2004, 387.) Purchasing in the manufacturing industry, where I also operate, can be divided in to two different processes. Main activities in those two process are as follows: Sourcing – a process of selecting suppliers, defining supplier contracts, collaboration with product design, procurement of materials for pre-production and evaluating supplier performance. Operative purchasing – a process of purchasing materials from selected suppliers, continuous supplier management and performance evaluation, serving operations to fulfill cost, quality and lead time requirements among other tasks.

Sourcing has the most impact for a company, when collaboration and supplier decisions are made with multiple internal stakeholders. That includes, but is not limited to, purchasing, manufacturing, engineering, operative planning and different business units. (Chopra & Meindl 2004, 388-389.)

TCO is a widely used abbreviation to define also the hidden or not so visible cost factors. One way to define TCO is to use an iceberg as an example. Initial costs are the ones that are seen instantly, the tip of the iceberg. Life cycle costs are hidden under the water, and if neglected in the initial cost calculations, may come as an unwelcome surprise. The same way as in an iceberg, initial costs are only a portion of the TCO, sometimes well less than half of the TCO (Government Procurement Branch 2013, 5).

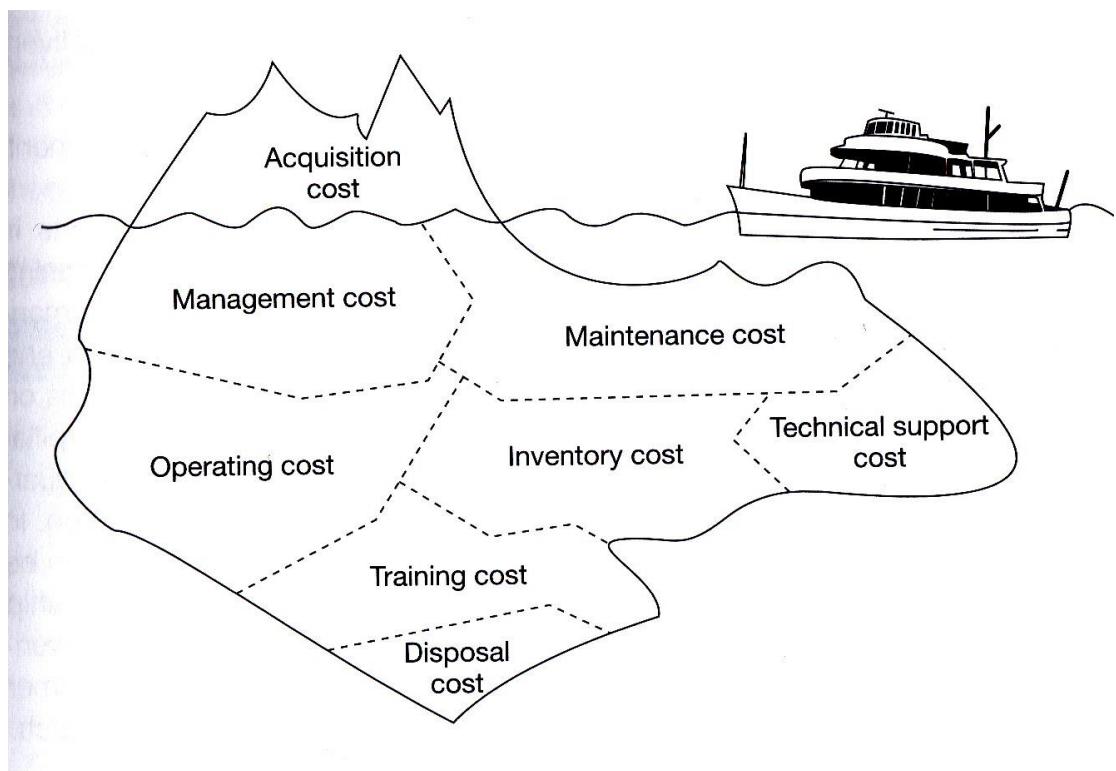


Figure 1. Total cost of ownership (Christopher 2011, 26)

Sunil Chopra et al. say in their book (Chopra & Meindl 2004, 388-389) that sourcing has five key processes. Those processes are:

1. Supplier scoring and assessment
2. Supplier Selection and Contract Negotiation
3. Design Collaboration
4. Procurement
5. Sourcing Planning and Analysis

Benefits from these key processes are:

1. Better economics of scale can be achieved.
 2. Overall cost of purchasing can be significantly reduced by efficient purchasing transactions.
 3. Design collaboration will probably result to better design for manufacturing and therefore lower the overall costs.
 4. Lower inventories can be achieved by better coordination with suppliers
 5. Good contracts will result into shared risk and win-win situation between buyer and supplier.
 6. By adding competition between suppliers lower cost can be achieved.
- (Chopra & Meindl 2004, 388-389.)

When these above mentioned benefits are considered, it can be stated that sourcing and procurement are one of the key processes in the whole manufacturing chain. Often nearly 50 % of COGS comes from purchased components, so margins are made or destroyed during purchasing. (Chopra & Meindl 2004, 388.)

5.2 Medical device manufacturing

Medical device manufacturing requires somewhat different processes than other manufacturing sectors. One of the most important factor is the traceability of the components, manufacturing equipment and records that need to hold. For the supply chain this causes some special circumstances. Traceability requires the manufacturer of the device to be able to show long downstream where, when and by with materials the devices were manufactured. Raw materials need to fulfill the requirements set by the owner of the design as well as different regional and global standards for reduction of harmful substances. (European Parliament; Federal Drug Administration 2015).

These regulatory and customer specific requirements makes the supply chain management in medical device manufacturing demanding. What is also extremely important, is the risk management and overall leadership and mastering of the supply chain.

6 Risk management in the supply chain

Marketplaces of today are turbulent and volatile. For medical devices that is also true, but more focus should be placed on managing the risk that threatens the security of the supply chain. Appropriate programs and mitigations are needed to manage those risks because of the vulnerability of the supply chain. (Christopher 2011, 189)

6.1 Risk categories

A risk can be categorized into several different categories. Sunil Chopra and ManMohan S. Sodhi presented in their management review nine different categories, which are presented in figure 2. Each of these risks have different type of drivers. In order to manage the different category risks, one has to understand the drivers. (Chopra & Sodhi 2004)

Category of Risk	Drivers of Risk
Disruptions	<ul style="list-style-type: none"> ■ Natural disaster ■ Labor dispute ■ Supplier bankruptcy ■ War and terrorism ■ Dependency on a single source of supply as well as the capacity and responsiveness of alternative suppliers
Delays	<ul style="list-style-type: none"> ■ High capacity utilization at supply source ■ Inflexibility of supply source ■ Poor quality or yield at supply source ■ Excessive handling due to border crossings or to change in transportation modes
Systems	<ul style="list-style-type: none"> ■ Information infrastructure breakdown ■ System integration or extensive systems networking ■ E-commerce
Forecast	<ul style="list-style-type: none"> ■ Inaccurate forecasts due to long lead times, seasonality, product variety, short life cycles, small customer base ■ "Bullwhip effect" or information distortion due to sales promotions, incentives, lack of supply-chain visibility and exaggeration of demand in times of product shortage
Intellectual Property	<ul style="list-style-type: none"> ■ Vertical integration of supply chain ■ Global outsourcing and markets
Procurement	<ul style="list-style-type: none"> ■ Exchange rate risk ■ Percentage of a key component or raw material procured from a single source ■ Industrywide capacity utilization ■ Long-term versus short-term contracts
Receivables	<ul style="list-style-type: none"> ■ Number of customers ■ Financial strength of customers
Inventory	<ul style="list-style-type: none"> ■ Rate of product obsolescence ■ Inventory holding cost ■ Product value ■ Demand and supply uncertainty
Capacity	<ul style="list-style-type: none"> ■ Cost of capacity ■ Capacity flexibility

Figure 2. Risk categories and their drivers (Chopra & Sodhi 2004, 54)

Another approach can be found in Martin Christopher's book *Logistic & Supply Chain management* (Christopher 2011). He proposes that supply chain risks can be categorized in five main sources:

1. Supply Risk, any disruptions in the supply chain.
2. Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect.
3. Process Risk, are our processes resilient and can we have additional capacity if needed.
4. Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain.

5. Environmental Risks, any external force that can disturb the supply chain.

Both Martin Christopher and Sunil Chopra identifies the same elements and sources of potential risks. My personal experience from the industry also supports the presented sources, but more interlinks can be found from Martin Christopher's sources, so I will explain more deeply the different risks on the following chapters based on Martin Christopher's categorization. (Christopher 2011)

6.1.1 Supply Risk, supply chain breakdown

A supply chain can face a partial or a complete breakdown. Partial breakdown can mean delay in the shipment, short of delivery, quality problems and so on. Complete breakdown can occur by for example natural disaster, financial reasons, political reasons accidents etc. Complete breakdown is a procurement professional's nightmare to be avoided. Breakdown can be caused by several different reasons, and to manage all these can be extremely difficult. As important as managing these risks, is the survival strategy after breakdown. (Chopra & Sodhi 2004, 1-2)

One recent example of the supply chain breakdown can be found from telecom industry. Sunil Chopra and ManMohan S. Sodhi studied the different strategies between Nokia and Ericsson, after their common chip supplier in New Mexico faced a fire in their manufacturing plant in 2000. The effect of that fire was that the complete production was stopped for long period of time. Nokia had secured earlier a second supplier while Ericsson was dependent on that sole chip supplier. Nokia was able to continue its own production thanks to the second supplier while Ericsson had to wait until the damages were repaired at their supplier site. (Chopra & Sodhi 2004, 2)

These different survival strategies prove, that while anything can happen, and supply chain can break down, it is very important to have survival strategy existing for those unwanted and rare, but possible occasions.

6.1.2 Demand Risk

Today's manufacturing industry faces constant challenge of response time to meet the increasing levels of volatility in demand. As Martin Christopher writes in his book, organization needs to focus its efforts on achieving greater agility. This means that the organization has to be able to respond in shorter time-frames for both demand in the markets and variety change. (Christopher 2011, 99)

A popular method to manage inventory costs and volatility in the demand is to apply so called Lean Manufacturing system. This system has its origins in the Toyota production system (TPS). In this system, the manufacturing party tries to keep its inventories as low as possible and requests suppliers to either keep security stocks or to have a fast response time. By requiring a fast response time, the organization is introducing a new supply chain risk, delay or lack of supply. (Christopher 2011, 100)

There are multiple possible reasons that can create lack or delay in the supply. The reasons can emerge from the nature, politics, accidents, financial reasons etc. It is important to understand the basic root cause for this risk and to find an appropriate tool for managing it. By keeping high inventory levels, problems are hidden but with high costs. Figure 3 shows the principle by having a boat floating over a lake full of rocks (risks, problems) but sailing without problem with high inventories (water level).

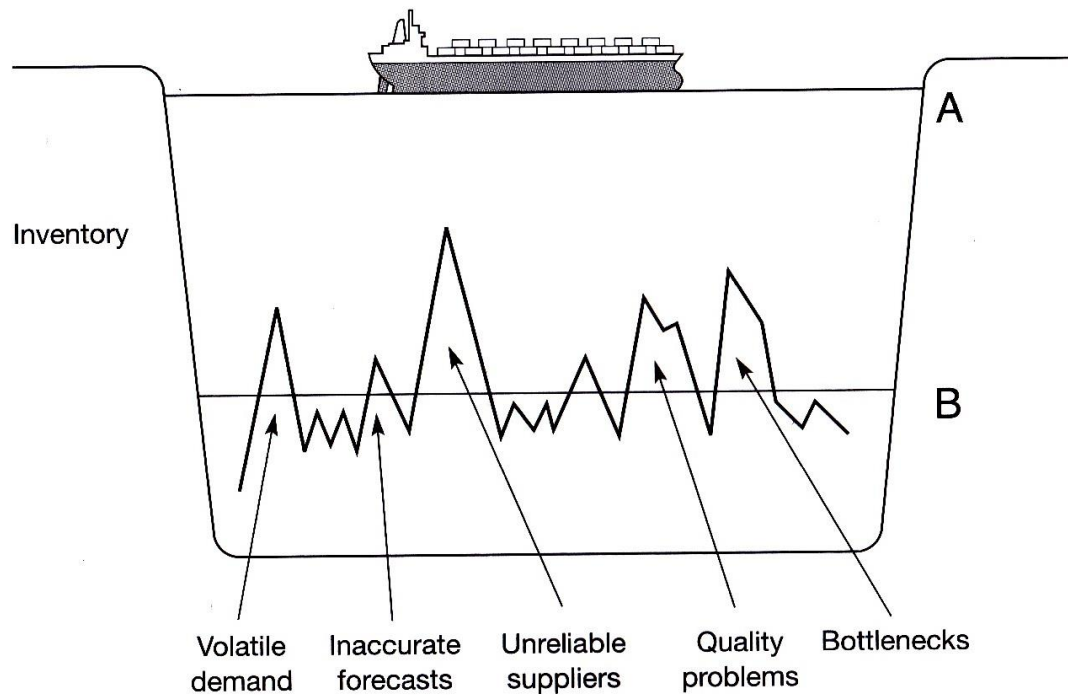


Figure 3. Inventory hides the problems. (Christopher 2011, 110)

6.1.3 Process Risk

In order to manage process risk, it is important to identify corporation's internal processes that may fail when fulfilling supply chain demand.

1. Purchased components have an effect in manufacturing yields, equipment and utilization rate.
2. Components may have internal quality issues that may result into rework of the components or finished goods.
3. Corporation internal warehousing processes may have an effect to fulfilment of the demand.
4. Business systems, such as enterprise resource planning (ERP) may have a failure that prevents fulfilling ordering against demand.
5. If a company has transportation under its control which can also fail.

(Cranfield University 2003, 19)

Managing process risk can be arranged by several means. Traditional ways are inventory management, capacity management, dual sourcing, distribution, and

logistics alternatives and back up arrangements. Other process specific risk mitigation tools are company's core processes, such as certified quality systems and different types of lead-time reduction programs. (Cranfield University 2003, 20-22)

6.1.4 Control Risk

Control risk is linked to the process risk, but has slightly different nature. Control risk is an internal driver that is caused by organizations own operations and procedures. Internal assumptions, rules, systems and different procedures are the organizations control over the processes. In supply chain management, these risks are batch sizes, order quantities, safety stocks and so on. The risk is formed when these internal rules are applied or misapplied. (Cranfield University 2003, 19)

6.1.5 Environmental Risks

Environmental risk is an external risk by its nature. From the organization perspective, the risk may be uncontrollable. Different events are environmental by nature, such as natural disasters, labor disputes, political actions, criminal activities (such as terrorist attacks) and economical disturbances. These types of events are hard to predict and any organization may have a difficult time to protecting itself from these risks. Supply chain management parties must keep themselves well aware of the world around them. (Cranfield University 2003, 18)

6.2 Risk management theories

One of the earliest theories and studies related to categorizing purchased items into risk analysis matrix was published in 1983 in Harvard Business review by Peter Krajlic (Krajlic 1983). His approach was straightforward model, where

each component and or commodity is judged by its importance and criticality. By placing the purchased items into the model, one can utilize different purchasing strategies to reduce and control risk related to these items. (Krajlic 1983)

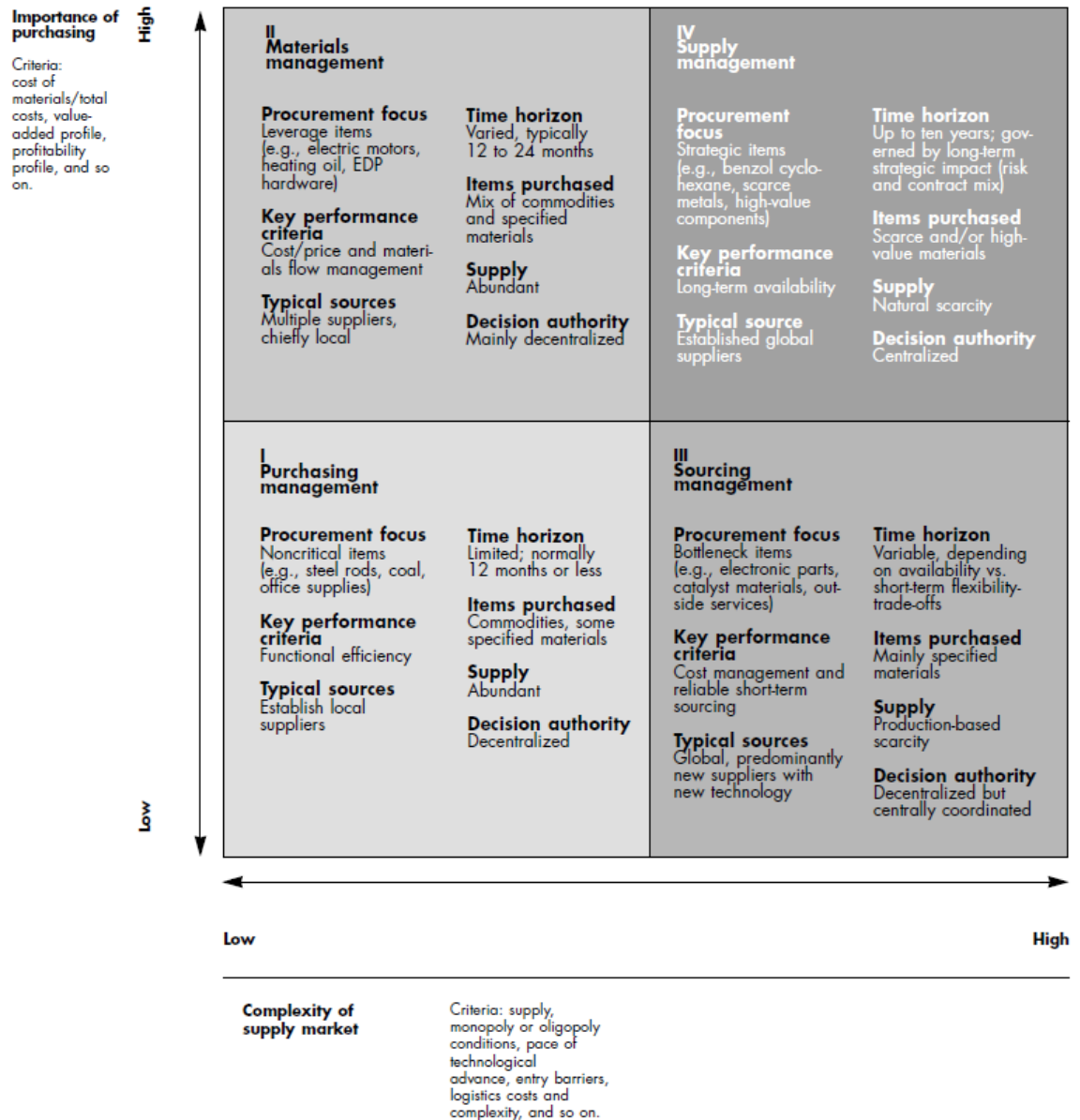


Figure 4. Categorizing purchased items. (Krajlic 1983)

When components or commodities are placed in the risk matrix presented above, different types of mitigations, or risk management tools, are taken into action. By utilizing different type of approach into different categories, the effectiveness of the mitigation becomes more powerful. Also, by utilizing this approach, time is spent there where it most matters the most.

Krajlic’s approach has been studied later on and some new theories and variations to the original model have been introduced. Cees J. Gelderman et al. wrote an article for Journal of Purchasing and Supply Management, where they took the original model under review to answer measurement issues and strategic directions. Those are two elements that have gathered criticism over the year for the original model. (Gelderman & Van Weele 2003, 207-216).

6.3 Managing risks

There are several toolkits available for one to manage and reduce the risks to materialize. One example can be found in Figure 5 below.

Six Sigma Methodology (DMAIC)	Supply Chain Process Risk Management (IMPARC)	Tools and Techniques	Scenario Planning	Delphi Forecasting	Brainstorming	Failure Modes and Effect Analysis (FMEA)	Flowcharting	Supply Chain Mapping	Critical Path Analysis	Bottleneck Identification	Statistical Process Control	Process Capability Analysis	Simulation Modelling	Root Cause Analysis	Fishbone Diagram	Pareto Analysis	Process Decision Programme Chart	Benchmarking	Business Process Re-engineering	Time-based Process Mapping
Define & Measure	Identify, Measure & Prioritise		X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Analyse	Analyse										X	X	X	X	X			X		X
Improve	Reduce				X								X			X	X	X	X	X
Control	Control										X	X								

FIGURE A1.3: THE TOOLKIT

Figure 5. Toolkit for risk management (Cranfield 2003, 56)

This toolkit is based to the four main process steps.

1. Identify, measure & prioritize
2. Analyze
3. Reduce
4. Control

In each process step, there are different tools available, such as delphi forecasting, FMEA, brainstorming, root cause analysis and so on. One has to select appropriate tools for each process step and utilize the outcome to reduce the risk.

Similar approach is proposed by Martin Christopher in his book. (Christopher 2011). Approach can be found in Figure 6 below.

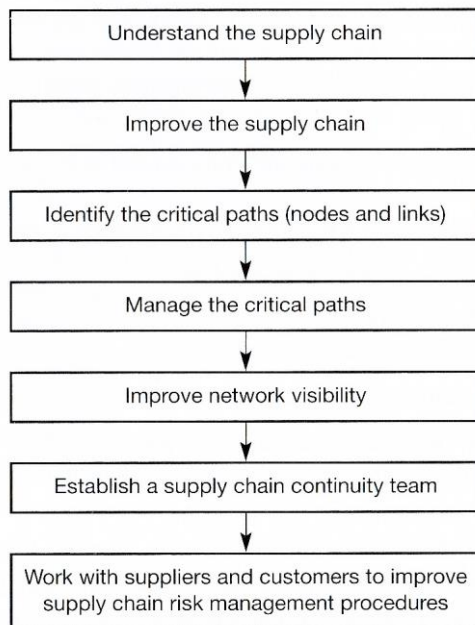


Figure 6. Supply chain risk management process. (Christopher 2011, 189)

Here the approach type is formed by seven main steps. By understanding the up- and downstream of the supply chain, one can better understand the drivers that affect the first, second and even third tier suppliers. Supply chain improvement is to simplifying and reducing variables and complexity in each process step involved. Critical path recognition can be challenging in complex supply chains. This, however, is essential in order to realize where the risks are hidden. Complex interlocks and nodes need to be revealed to identify critical paths. Once identified, it is time to start managing those critical paths. The first question is if the risks can be mitigated or removed completely. It may end up in the complete re-engineering of the supply chain, at the very extreme cases. Improving the visibility of the network may reveal hidden risks early enough so that reaction can be done in timely manner. These mentioned steps require proper re-

sources, and this can be assured by forming a dedicated supply chain continuity team. Finally, it is highly recommended to work with suppliers and customers to improve supply chain risk management. (Christopher 2011, 189-206)

7 Research methodology

The selected research methodology in this thesis is qualitative research. The purpose was to find out personal experiences of the subject under research as well as written information from literature. The primary source of information was literature review from various sources. Those sources were books, different journals, reports, observations and websites. The secondary source for acquiring data was theme interview. These methods are according to Jouni Tuomi's book (Tuomi J. & Sarajärvi A. 2000, 73) valid methods to gather information for qualitative research.

Theme interview survey was arranged and it was conducted as an e-mail survey. The participants were also given an opportunity to clarify questions by asking from researcher by phone or e-mail. This opportunity was also used by three participants. E-mail as the main method for survey was selected due to the fact that the participants were located in four different countries around Europe. These two options to answer and to ask clarifications gave flexibility for the survey. This is also highlighted in Jouni Tuomi's book (Tuomi J. & Sarajärvi A. 2000, 75) as a benefit of this type of surveys.

7.1 Theme interview survey

Interview survey was used to get hands-on experience from the people who have been working for a long time with supply chain management. Different types of risks and risk mitigation tools, presented in the chapters five and six of this thesis, were asked be evaluated based on participants own experiences.

Questions were by nature half-open and open. (Tuomi J. & Sarajärvi A. 2000, 80)

There were six participants altogether, three of them were from Phillips-Medsize and the rest were customers of Phillips-Medsize. Survey letter and invitation was sent to eight recipients, of out which two opted not to participate. The participants were selected by the researcher by using so called elite sampling method (Tuomi J. & Sarajärvi A. 2000, 88-89). This selection was to get the best possible information in a short period of time. The interview survey was conducted by e-mail, where the letter of explanation and actual survey questions were in the same document.

The survey letter and questions are as appendices of this thesis. Timeframe for the survey was arranged flexibly to the participants so that letter was sent at the beginning of January 2015 and responses were requested within three weeks after receiving the survey. The researcher was also available roughly at the same time zone during that three week period of time.

The survey was formed from three different sections. The first section was to map out the opinions of the participants of the most obvious risks associated to the supply chain. In the second section risk mitigations were asked to assess by the participants. The third and final section gave the participants an opportunity to answer the questions set by the researcher with their own words.

7.2 Theme interview, risk assessment

The questions are listed below as well as the answers given by the participants. The participants were asked to rank five different risks by giving them values from one to five. One presented the highest and most obvious risk

Supply Risk, any disruptions in the supply chain was presented as a first question. By this question, the researcher wanted to map if the participants have en-

countered disruptions in the supply chain by missing deliveries, poor quality or completely losing a supplier. Participants gave the following rankings:

- First participant: 1
- Second participant: 1
- Third participant: 1
- Fourth participant: 1
- Fifth participant: 3
- Sixth participant: 1

Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect was presented as a second question. This question was asked to see if there have been a lot of variations in the demand, creating volatility in the demand and needed supply. Bullwhip effect means that when the first tier supplier is dependable from second tier suppliers, volatility in the demand may come back to the original buyer. The participants gave the following rankings:

- First participant: 2
- Second participant: 4
- Third participant: 3
- Fourth participant: 3
- Fifth participant: 2
- Sixth participant: 2

Process Risk, are our processes resilient and can we have additional capacity if needed was presented as a third question. In this risk, the researcher wanted to find out if participants have trust in their own processes, such as Enterprise resource planning (ERP), and do those systems and processes support the supply chain management or do they create unwanted risks. Participants gave the following rankings:

- First participant: 3
- Second participant: 2
- Third participant: 4
- Fourth participant: 2
- Fifth participant: 1
- Sixth participant: 4

Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain was presented as a fourth question. This risk is almost the same as the previous one (Process risk), but is different in nature. This risk is pointing more heavily to the written rules, regulations, assumptions and procedures inside the organization that can cause chaos in the supply chain into. The participants gave the following rankings:

- First participant: 2
- Second participant: 3
- Third participant: 2
- Fourth participant: 3
- Fifth participant: 4
- Sixth participant: 3

Environmental Risks, any external force that can disturb the supply chain was presented as a fifth question. This is something that hardly anyone working on the supply chain has full control of. By this risk, the researcher was pointing to external forces, such as natural disasters, political issues, terrorist activities and so on. The participants gave the following rankings:

- First participant: 5
- Second participant: 4
- Third participant: 5
- Fourth participant: 3
- Fifth participant: 5
- Sixth participant: 5

7.3 Theme interview, risk mitigation tools

These questions were focused on how to mitigate and managing risks. There were altogether six pre-set risk mitigation tools and the survey participants were given an opportunity to set one additional tool, if they found it appropriate. The participants were asked to rank pre-set risks with numbers one to six, with one

presenting the most powerful and effective tool. Risk mitigation tools and answers given by the participants are below.

The first risk mitigation tool; Multisource

Multisource means that there is an alternative supplier existing for a single component or service. This risk mitigation tool was ranked by participants as follows:

- First participant: 3
- Second participant: 1
- Third participant: 1
- Fourth participant: 2
- Fifth participant: 6
- Sixth participant: 1

The second risk mitigation tool; Vendor managed inventory / Safety stocks

Vendor managed inventories and/or safety stocks are common practice in the industry to keep the supply chain under control. By this risk mitigation tool, the risk is shared between the buyer and the supplier. The participants ranked this mitigation tool with the following rankings:

- First participant: 3
- Second participant: 4
- Third participant: 2
- Fourth participant: 3
- Fifth participant: 5
- Sixth participant: 2

The third risk mitigation tool; Local source

Local source means that for a component or service there is a supplier available with close proximity of the buyer. This mitigation tool was ranked by participants with the following rankings:

- First participant: 2
- Second participant: 3
- Third participant: 6
- Fourth participant: 2

- Fifth participant: 2
- Sixth participant: 6

The fourth risk mitigation tool; Frame agreement

Frame agreement is a written contract between supplier and buyer, where both parties agree on terms and conditions for a supply. This mitigation tool was ranked by participants with the following rankings:

- First participant: 2
- Second participant: 3
- Third participant: 3
- Fourth participant: 3
- Fifth participant: 4
- Sixth participant: 3

The fifth risk mitigation tool; Supplier pre-screening for financials

Supplier pre-screening is coming more popular, as the global economy has faced several downturns in the recent years. By screening the supplier before making decisions of buying, the supply chain management can see if there is something to be worried about. The participants gave the following rankings for this risk mitigation tool:

- First participant: 1
- Second participant: 4
- Third participant: 5
- Fourth participant: 2
- Fifth participant: 3
- Sixth participant: 4

The sixth risk mitigation tool; Strategic partnership

Strategic partnership is a form of alliance, where the buyer and the supplier make close co-operation and share the information between them much more openly than with normal buyer/supplier relationship. The participants ranked this risk mitigation tool as follows:

- First participant: 3
- Second participant: 2

- Third participant: 4
- Fourth participant: 1
- Fifth participant: 1
- Sixth participant: 5

The last risk mitigation tool gave the participants an opportunity to add a tool, if they have one. Altogether three participants added their own tool, or a tool that they are familiar with. These were:

- Change control
- Earlier experience with the supplier
- Including site with different (separate) buildings/structures

8 Analysis of the survey

The interview survey answers were analyzed by using two methods. The first one was to place the first two ranking questions onto an Excel sheet and see what percentages each question/risk mitigation received. This approach reflects the process of analyzing information as presented by Jouni Tuomi in his book (Tuomi J. & Sarajärvi A. 2000, 110-111). The second was to analyze open questions and to see what each participant is thinking of and what the past experiences on those questions are. This phase followed the same process described earlier.

In the second ranking question a little bit room was left for flexibility to the participants. Even though that this is typically instructed to be ignored in the qualitative research (Tuomi J. & Sarajärvi A. 2000, 94), the researcher wanted to see if he has ignored something from his literature examinations.

8.1 Analysis of the first questions

Each risk had an opportunity to be either 1 as the highest probability or maximum 5, for the least probable.

Question	Average	Ranking	First participant	Second participant	Third participant	Fourth participant	Fifth participant	Sixth participant
Supply Risk, any disruptions in the supply chain	1,3	1	1	1	1	1	3	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	2,7	2	2	4	3	3	2	2
Process Risk, are our processes resilient and can we have additional capacity if needed	2,7	2	3	2	4	2	1	4
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	2,8	4	2	3	2	3	4	3
Environmental Risks, any external force that can disturb the supply chain	4,5	5	5	4	5	3	5	5

Figure 7. Excel analysis of the first questions

Ranking points given by the participants were placed on Excel sheet. All the points were then added together and divided by the participant amount. That gave each the average weighting. After that, the risks were manually put into ranking order by the researcher based on the average weighting.

According to the results above, the risks in the survey are ranked as follows:

1. Supply Risk
2. Demand Risk
2. Process Risk
4. Control Risk
5. Environmental Risk

The highest and most probable risk is the supply risk. That is quite natural and is the kind of risk that will have an immediate and hard impact on any organization. The second highest is the demand risk, where fluctuation on the demand may influence the available capacity from the supplier. As probable as the demand risk, is the process risk. That is something that any organization should take seriously. There are many recent examples of the internal process to falling down and causing huge problems in deliveries. One example comes from automotive industry. The BMW Group changed its central logistics system which in return caused some part supply shortage and delays of car deliveries. (Reuters 2013)

The control risk came as the fourth probable, and is similar in type as the process risk. There cannot be too much attention paid at any organization to the internal processes. The least probable risk according to this survey was the environmental risk. That is somewhat surprising to me, as there have also been recent examples of environmental risks materializing. One notable one was the big earthquake and the eventual tsunami in the coastal areas of Japan in 2011. (Wikipedia 2015)

8.2 Analysis of the second questions

Each risk mitigation tool had an opportunity to be either 1 as the most effective tool or maximum 6 as the least effective.

Question	Average	Ranking	First participant	Second participant	Third participant	Fourth participant	Fifth participant	Sixth participant
Multisource	2,3	1	3	1	1	2	6	1
Vendor managed inventory / Safety stocks	3,2	4	3	4	2	3	5	2
Local source	3,5	6	2	3	6	2	2	6
Frame Agreement	3,0	3	2	3	3	3	4	3
Supplier pre-screening for financials	3,2	4	1	4	5	2	3	4
Strategic partnership	2,7	2	3	2	4	1	1	5
Other, please specify:			N/A	Change control	Earlier Experience with the supplier	including site with different (separate) buildings/structures	N/A	N/A

Figure 8. Excel analysis of the second questions

Ranking points given by the participants were placed on excel sheet. All the points were then added together and divided by the participant amount. That gave each the average weighting. After that, the risks were manually put into ranking order by the researcher based on the average weighting.

Variation between different risk mitigations was quite low. All of the risk mitigations seem to be well known and widely used. In the different positions in supply chain management, one can work more effectively than another. When we take this survey, its participants and the results out of it, we come to the following ranking in the risk mitigation effectiveness:

1. Multisource
2. Strategic partnership
3. Frame Agreement
4. Vendor managed inventory / safety stocks
4. Supplier pre-screening for financials
6. Local Source

Multisource appeared as the most effective tool to mitigate risk according to the survey participants. I can verify this also from my own experience, and several examples in the past also show its importance and effectiveness. Second in the

survey came strategic partnership. This is also based on my experience very important and effective tool for risk mitigation. Good supplier relationship can have a huge impact on securing the supply chain. The third powerful mitigation tool in the survey according to the participants is frame agreement. This is a similar tool and method to the previous one, strategic partnership, but is more formal way of making sure partnership is established. Vendor managed inventory / safety stocks and supplier pre-screening for financials divided the fourth place in the survey. Safety stocks and or vendor managed inventories are somewhat understandable, as these tools will enable at least to some extent securing of the supply. Typically these safety stocks are only between 1-3 months demand so much attention still needs to be given to the supplier. Supplier pre-screening for financials is quite important and I widely use it when evaluating suppliers and to mitigate risks. Innovative companies and new technologies are intriguing for the engineers, but care has to be taken to ensure the supply chain existence. The least popular risk mitigation method according to the survey was local source. This is also true in the global working environment. There simply might not exist a local supplier that could fill the project needs.

The survey participants were given an opportunity to give their own risk mitigation method, if the one they are familiar with was not shown. There were altogether three additional risk mitigations given.

1. Change control
2. Previous experiences with the supplier
3. Including site with different buildings/structures

These were valuable additions to the writer, they are quite generic mitigation methods but powerful.

The first one state that change control could be used as risk mitigation tool. That is absolutely so as keeping the supplier aware of the possible revision changes and/or changes in the part geometry will reduce the risk of receiving incorrect material.

The second added mitigation states that the previous experiences with the supplier works also as mitigation tool. It is always easier and safer to work with the supplier you know from the past. That will give you some safety of the supplier performance, but care has to be taken. Things have tendency to change and existing supplier relationship have to be checked regularly to keep information of the supplier up-to-date.

The third mitigation tool added points to the importance of having separate buildings/structures at supplier site. By having multiple sites and buildings, natural disasters, fire etc. unforeseen events are not so likely to disturb the supply chain.

8.3 Conclusions from the free word survey

In the first question the participants were asked, if they conduct annual /repeated evaluation of the suppliers and their operational risks. Out of the six participants, all six answered that there exist a process to do that evaluation.

The second question was meant for pre-evaluation of the suppliers, and if there is such a screening process existing. Out of the six participants, four answered that there is pre-screening in place.

The third question was if there are business continuity plan requirements in place towards the suppliers. Only two participants said firmly that such a demand exists, two said probably and rest two answered no to this question.

In the fourth question the researcher wanted to know how easily one supplier could be changed, if such a need arose. There were mixed answers among the participants. Out of the six, three said that changes are limited or low. Two participants pointed that there is formalized process or team available to do change. One said that changing a supplier is dependent on the product or service in question.

The fifth question was made to get information if the participant has encountered a supply chain breakdown. Four participants had not encountered such a catastrophe and two has.

The sixth question was then meant as a follow-up question to the fifth question. If one has experienced such a breakdown, how did he or she survive it. Two participants, who had experienced supply chain breakdown, had different survival strategy existing. One had multi-source supply base and the other had dedicated task team to find alternative supplier for survival.

The seventh question was a follow-up question to the fifth and sixth question. If a supply chain breakdown has been encountered, had there been any new risk mitigation tools taken in force after that. Two participants, who had encountered the supply chain break down, had not had a need to take new risk mitigation is use after the crisis.

The eighth and final question was pointed to the regular face to face meetings among suppliers. The researcher wanted to hear if regular meetings are seen as added value in supply chain management. Out of the six participants, four were strongly in favor of having such meetings, one was completely against those and one was somewhat in between those two ends.

9 Results

When thinking of the conclusions, we have to think what we wanted to find out. The first ranking questions were meant to find out if risks are familiar to participants and who have they seen the consequences in the past. It came as no surprise that the most familiar and probable risk among the participants is supply risk. The lack of the supply will halt any operations in a very short time if there are no alternative strategies in place. What came somewhat as a surprise was that the environmental risk was not seen as a big factor. That can be explained by assuming that the supply base is located in steady and low risk are-

as of the world. Natural disasters still happen and they can have big influence for the supply chain reliance. (CRN 2015)

The second ranking question focused on the risk mitigation tools and their usage among the participants. A widely used and famous strategy is multi source. If there is possibility to divide the demand between two or more suppliers, one should consider that as a viable option. Partnering and having formalized frame agreements existing adds security for the supply chain stability. Local source of product or service was widely seen as the least powerful mitigation tool among the participants. Personal experiences have also been similar, there is little or no added value to use a local instead of a global supplier from the risk mitigation point of view.

The last chapter in the survey gave the participants a chance to answer with their own words based on their own experiences. Widely used tool for making supply chain risks lower, is to use pre-screening and financial background checks. This particular tool was also the most popular and well-known among the participants. Pre-screening and financial background checks have a tendency to reveal if the business, where supplier is working, has been successful and prosperous over the years. If there is little or no history with the supplier, one should proceed with caution. Supply chain breakdown and the experiences around that was the most intriguing question in the researchers mind. Examples from the literature and other input from the work life indicated that such an incident is possible, and may have huge impact the operations. Out of the participants, two had experienced this type of materialized risk. Even more interesting were the survival strategies that had helped to overcome the situation. One participant wrote that there was a multi-source strategy already in place, while the other had to rely on specific task team to find local or global alternative. These two survival strategies are actually very similar to the earlier presented example, where Nokia survived their supply chain breakdown thanks to task team and multi-source strategy. (Chopra S. & Sodhi M. 2004)

This is one important outcome of this work. There are now several leads indicating that a single source is a bad thing if there is any disturbance in the supply

chain. Several risks identified earlier in the work, such as supply risk, demand risk and environmental risk can be controlled by utilizing multi-source strategy. By having two or more suppliers for one product or service, risk of the complete supply chain breaking is significantly reduced.

The second important outcome of this work, is that leadership has to be proven in supply chain management. To have a significant impact on the organization, integrating supply chain management to the several levels of operational management, will lead to overall high level of excellence. Whether it is individual or organizational leadership, both are needed to master the supply chain. Recent study from Accenture (Accenture 2014) suggest, that true industry leaders in supply chain management, make risk management and operations their top priority. In the same study it is suggested that there should be formed a formalized protocol to discuss supply chain risks in management meetings. Even a dedicated risk management officer on corporate level should exist. Generally, a culture of understanding supply chain risks as highly important factor should be adopted in to the organization. (Accenture 2014, 9)

It is not possible to complete avoid risks from materializing. By committing to the operations and supply chain risk management, an organization can protect itself from the impacts of the disruptions in the supply chain. This will eventually also lead into greater economic returns. (Accenture 2014, 12)

After this research, it would feel inappropriate not to make any suggestions. Based on the results of the study, two main recommendations to the commissioning organization are as follows:

- Create a formalized risk management forum to review risks related to supply chain
- Allocate a person or a part of one person's work time to focus on risk assessment and management

The reliability of the research has to be estimated, as all the research work aims at avoiding mistakes (Tuomi J. & Sarajärvi A. 2000, 131). Information received from the literature was estimated by reflecting any individual information to sec-

ondary source. Literature sources were borrowed from public libraries, bought or found otherwise from colleagues and internet sites.

In the theme interview survey, all participants will remain anonymous and their answers to the survey are ensured not to reveal their identity. Answers for the survey were requested to be placed on word file, which are stored on hard drive and DVD-disc. The original e-mails are not stored. The amount of the participants was originally thought to be eight, but two of opted not to participate. Therefore six remained but that can also thought to be sufficient amount when researcher utilized elite sampling method.

The complete duration of this research was more than six months. The analysis of the information is done with source criticism and if there was an alternative source for the same topic available that was also used.

10 Final words

When making this master thesis, the writer also participated in the full time work within the supply chain management. This gave some valuable input for the study and also made the analysis of the results very fruitful. Overall, making this work was very beneficial and many of the mitigation tools presented in this work were also used in practice. Luckily none of the risks have so far materialized, but if they do in the near future, the researcher believes that he is prepared to face them.

Time management proved to be very critical, as there was very little extra time left after the full working days to focus on this research. The researcher is therefore very grateful to his employer which also is the commissioner of this study, for the support and understanding of the need to have some time off to focus on this work.

Support from the Karelia University of Applied Science, especially from Mr. Kari Mönkkönen and Mr. Kim Wrangé, was very much needed. As the writer has no previous experience on writing this type of thesis, the support was very welcome.

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Appendices

Appendix 1 – Theme interview motivation letter and questions

Dear recipient

I am studying Master of Technology in Technology Competence management and my thesis is focusing on Risk management at Supply Chain management. The purpose of this survey is to broaden the available view from existing literature to the world where we all work on.

This thesis is made for Medisize Oy, Kontiolahti Finland plants.

I would appreciate your input to my work by answering the following survey. All answers to this survey will be treated as highly confidential and none of the persons participating to this can be identified. All participants have an option to review the results before they are published and have VETO right to remove one or all of their answers if they feel like it.

If you have any questions I can be contacted at:

Mobile: +xxx xxx xxxxx

e-mail: xxx.xxx@xxx.xxx

Please return your filled survey sheet to:

e-mail: xxx.xxx.@xxx.xxx

Sincerely, Sami Karppinen

Theme interview survey questions

Please rank the most obvious and probable risks from your perspective (1-5), 1 is the highest

Supply Risk, any disruptions in the supply chain	
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	
Process Risk, are our processes resilient and can we have additional capacity if needed	
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	
Environmental Risks, any external force that can disturb the supply chain	

Please rank following risk mitigations (1-6), 1 is the highest

Multisource	
Vendor managed inventory / Safety stocks	
Local source	
Frame Agreement	
Supplier pre-screening for financials	
Strategic partnership	
Other, please specify:	

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how?

Do you do pre-screening and do you follow of your suppliers' financial results?

Do you require Business continuity plan for your suppliers or do you do that for them?

What are your capabilities to replace critical suppliers?

Have you experienced a supply chain breakdown?

How did you recover from that crisis?

Have you taken a new risk mitigations in use after that crisis?

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

Appendix 2 – Participant 1 answers

Please rank the most obvious and probable risks from your perspective (1-5) 1 is the highest

Supply Risk, any disruptions in the supply chain	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	2
Process Risk, are our processes resilient and can we have additional capacity if needed	3
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	2
Environmental Risks, any external force that can disturb the supply chain	5

Please rank following risk mitigations (1-6) 1 is the highest

Multisource	3
Vendor managed inventory / Safety stocks	3
Local source	2
Frame Agreement	2
Supplier pre-screening for financials	1
Strategic partnership	3
Other, please specify:	n.a.

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how?

Yes, by audits and frequent visits

Do you do pre-screening and do you follow of your suppliers' financial results?

Not really

Do you require Business continuity plan for your suppliers or do you do that for them?

no

What are your capabilities to replace critical suppliers?

In case of specific equipment or customized components its pretty low

Have you experienced a supply chain breakdown?

no

How did you recover from that crisis?

n.a.

Have taken new risk mitigations in use after that crisis?

n.a.

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

yes

Appendix 3 – Participant 2 answers

Please rank the most obvious and probable risks from your perspective (1-5), 1 is the highest

Supply Risk, any disruptions in the supply chain	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	4
Process Risk, are our processes resilient and can we have additional capacity if needed	2
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	3
Environmental Risks, any external force that can disturb the supply chain	4

Please rank following risk mitigations (1-6), 1 is the highest

Multisource	1
Vendor managed inventory / Safety stocks	4
Local source	3
Frame Agreement	3
Supplier pre-screening for financials	4
Strategic partnership	2
Other, please specify:	Change control

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how?

Audit, and pre-questionnaire

Do you do pre-screening and do you follow of your suppliers' financial results?

yes

Do you require Business continuity plan for your suppliers or do you do that for them?

Yes we require

What are your capabilities to replace critical suppliers?

Pretty bad due requirement of revalidation of the product

Have you experienced a supply chain breakdown?

Yes

How did you recover from that crisis?

Earlier life by having multi source strategy

Have taken new risk mitigations in use after that crisis?

No

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

No

Appendix 4 – Participant 3 answers

Please rank the most obvious and probable risks from your perspective (1-5) 1 is highest

Supply Risk, any disruptions in the supply chain	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	3
Process Risk, are our processes resilient and can we have additional capacity if needed	4
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	2
Environmental Risks, any external force that can disturb the supply chain	5

Please rank following risk mitigations (1-6) 1 is highest

Multisource	1
Vendor managed inventory / Safety stocks	2
Local source	6
Frame Agreement	3
Supplier pre-screening for financials	5
Strategic partnership	4
Other, please specify:	earlier experience with supplier

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how?

Yes, continues screening and monitoring

Do you do pre-screening and do you follow of your suppliers' financial results?

For OEM suppliers yes, for the 2nd tier supplier less

Do you require Business continuity plan for your suppliers or do you do that for them?

Case by case pending on size, origin and criticality

What are your capabilities to replace critical suppliers?

Most cases I experienced, a critical supplier are not replaceable.

Have you experienced a supply chain breakdown?

Yes.

How did you recover from that crisis?

Task team for seeking alternatives locally and globally.

Have taken new risk mitigations in use after that crisis?

No

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

From my experience, supplier visits at the production site are a must

Appedix 5 – Participant 4 answers

Please rank the most obvious and probable risks from your perspective (1-5), 1 is the highest

Supply Risk, any disruptions in the supply chain	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	3
Process Risk, are our processes resilient and can we have additional capacity if needed	2
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	3
Environmental Risks, any external force that can disturb the supply chain	3

Please rank following risk mitigations (1-6), 1 is the highest

Multisource	2
Vendor managed inventory / Safety stocks	3
Local source	2
Frame Agreement	3
Supplier pre-screening for financials	2
Strategic partnership	1
Other, please specify:	multi site (including site with different (separate buildings/structures))

Please answer to the following question with free words:

[Do you follow your supplier operational risks and capabilities? If so, how?](#)

We do regular Supplier assessments before supplier selection. We risk assessments either thru internal departments or external partners depending on criticality of the product for our business.

Do you do pre-screening and do you follow of your suppliers' financial results?

Yes

Do you require Business continuity plan for your suppliers or do you do that for them?

I would guess so, but I'm not 100% sure, as this is in the hands of our Partner and Vendor Management Department.

What are your capabilities to replace critical suppliers?

There is no general protocol. This will be handled case by case.

Have you experienced a supply chain breakdown?

Not yet, but I only judge on three years of this specific business.

How did you recover from that crisis?

n/a (see above)

Have taken new risk mitigations in use after that crisis?

n/a (see above)

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

Of course they are helpful, but cannot be the only measure to manage/prevent risks. More important is the basic setting and mind set of the partner.

Appedix 6 – Participant 5 answers

Please rank the most obvious and probable risks from your perspective (1-5), 1 is the highest

Supply Risk, any disruptions in the supply chain	3
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	2
Process Risk, are our processes resilient and can we have additional capacity if needed	1
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	4
Environmental Risks, any external force that can disturb the supply chain	5

Please rank following risk mitigations (1-6), 1 is the highest

Multisource	6
Vendor managed inventory / Safety stocks	5
Local source	2
Frame Agreement	4
Supplier pre-screening for financials	3
Strategic partnership	1
Other, please specify:	

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how?

Yes we do, with frequent detailed technical alignments

Do you do pre-screening and do you follow of your suppliers' financial results?

Not yet

Do you require Business continuity plan for your suppliers or do you do that for them?

Not yet

What are your capabilities to replace critical suppliers?

Escalating concerns or issues in direction of responsible department which is Partner and Vendor Management

Have you experienced a supply chain breakdown?

Not Yet

How did you recover from that crisis?

Not Yet

Have taken new risk mitigations in use after that crisis?

Not Yet

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises?

Yes definetly

Appendix 7 – Participant 6 answers

Please rank the most obvious and probable risks from your perspective (1-5), 1 is the highest

Supply Risk, any disruptions in the supply chain	1
Demand Risk, Is there much volatility in the demand seen and can it have a bullwhip effect	2
Process Risk, are our processes resilient and can we have additional capacity if needed	4
Control Risk, disturbances and distortions in our own internal control system can cause chaos in the supply chain	3
Environmental Risks, any external force that can disturb the supply chain	5

Please rank following risk mitigations (1-6), 1 is the highest

Multisource	1
Vendor managed inventory / Safety stocks	2
Local source	6
Frame Agreement	3
Supplier pre-screening for financials	4
Strategic partnership	5
Other, please specify:	

Please answer to the following question with free words:

Do you follow your supplier operational risks and capabilities? If so, how? Annual supplier evaluation

Do you do pre-screening and do you follow of your suppliers' financial results?

Pre-screening yes, follow up no

Do you require Business continuity plan for your suppliers or do you do that for them? Has been requested for one Japanese supplier, not in regular use.

What are your capabilities to replace critical suppliers? Very much depending on the purchased product or service

Have you experienced a supply chain breakdown? No

How did you recover from that crisis?

Have you taken new risk mitigations in use after that crisis?

From your experience, can you manage supplier related risks by having regular supplier visits or visit at supplier premises? Certainly helps