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MARKET POSSIBILITIES FOR NICKEL PRODUCTS IN
CHINESE BATTERY INDUSTRY: CASE NORILSK NICKEL
HARJAVALTA OY

Degree Programme in International Business

2017

MARKKINAMAHDOLLISUUDET NIKKELITUOTTEILLE KIINAN AKKU- JA PATTERNMARKKINOILLA: CASE NORILSK NICKEL HARJAVALTA OY

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Kansainvälisen kaupan koulutusohjelma
Huhtikuu 2017
Ohjaaja: Vahteristo, Ari
Sivumäärä: 42
Liitteitä: 4

Asiasanat: Markkinatutkimus, toimitusketju, b2b-markkinointi, akkuteollisuus

Tämän opinnäytetyön tarkoituksena oli tutkia Kiinan markkinoilla toimivia akkujen esiasteiden valmistajia, sekä tutkia Kiinan markkinamahdollisuuksia ja kysyntää case-yrityksen nikkeli tuotteille. Tutkimuksella pyrittiin saamaan tukea yrityksen tuotteiden markkinoinnille Kiinassa. Tutkimuksen teetti Norilsk Nickel Harjavalta Oy, merkittävä ja kansainvälinen nikkelikemikaaleja ja -metalleja valmistava ja jalostava yritys.

Aihetta tarjottiin minulle ollessani harjoittelussa yrityksessä. Valitsin aiheen koska se vaikutti sekä mielenkiintoiselta, että haastavalta. Aihe sopi hyvin opintoihini, sillä suuntauduin opinnoissani Aasian liiketoimintaan. Olin töissä yrityksessä koko opinnäytetyöprosessin ajan.

Tutkimus oli alun perin tarkoitus toteuttaa kvantitatiivisena tutkimuksena suorittamalla sähköinen kysely valituille kiinalaisille akkujen esiasteiden valmistajille. Vastauksia ei kuitenkaan saatu tarpeeksi kvantitatiivisen tutkimuksen toteuttamiseksi, joten tutkimusmenetelmä vaihdettiin kvalitatiiviseksi. Tästä johtuen materiaalia tarvittiin enemmän ja päätettiin haastatella Norilsk Nickel Harjavallan toimihenkilöä, Pekka Alisaarta. Saatuja vastauksia verrattiin keskenään ja Norilsk Nickelin aikaisemmin tuottamaan tutkimukseen.

Tulosten perusteella markkinoilla on odotettavissa suurta kasvua ja kysyntää nikkeli tuotteille tulee löytymään myös tulevaisuudessa enenevissä määrin. Case-yrityksen tuotteille on paljon markkinamahdollisuuksia Kiinan akku- ja patterimarkkinoilla. NNH Oy:n tuotteiden kaltaisille puhtaille nikkeli tuotteille löytyy kysyntää, mutta tuotteiden vienti Kiinaan on osin hieman haastavaa.

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Degree Program in International Business
April 2017
Supervisor: Vahteristo, Ari
Number of pages: 42
Appendices: 4

Keywords: Market research, supply chain, b2b marketing, battery industry

The purpose of this thesis was to study the battery precursor producers operating in the Chinese battery market and to investigate the market possibilities and demand for case company's nickel products. The study aimed to support the marketing of Norilsk Nickel Harjavalta Oy (NNH) products in China. The study was implemented on behalf of NNH, a big, international company producing and refining nickel based chemicals and metals.

The subject of this thesis was offered to me while I was doing my internship in the company. I decided to accept the subject as it seemed interesting and challenging. The subject also suited my studies as I oriented my studies on Asian business. I have been working in NNH for the whole time I was doing this thesis.

The study was originally meant to be a quantitative study implemented via an online survey to selected Chinese battery precursor producers. As not enough answers were received in order to properly execute the quantitative questionnaire, the study was amended into a qualitative study. For this reason, more material was needed and the Head of Technical Research and Analysis Service, Pekka Alisaari, from NNH, was interviewed. Received answers were compared with each other and with the study commissioned by Norilsk Nickel a year earlier.

According to the results, vast growth and big demand for nickel products can be expected in the future. There are great market possibilities for the case company's products in the Chinese battery market. Pure products such as the ones NNH can provide, have demand but the export to China can be a bit challenging.

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1 INTRODUCTION

The opening of the markets, globalisation and digitalisation creates lots of new possibilities for companies but also increases the pressure to internationalize. Although going international has gotten a lot easier than before, it still includes major risks for the companies. To expand on international markets a company needs to acquire competitive knowledge in order to succeed and avoid pitfalls. Conducting a market research is a way to gain important knowledge and understanding of the target market. A Market research is an irreplaceable tool for a company in decision making, minimizing risk-taking and figuring out new market potential.

The purpose of this thesis is to study the battery precursor manufacturers operating in the Chinese market and the market possibilities and demand for nickel products. The thesis is conducted for Norilsk Nickel Harjavalta Oy. The company is a nickel chemical and nickel metal manufacturer in Harjavalta, Finland. Later, I will refer to the company as case company or NNH. A market research for the Chinese battery industry is timely for the case company, since the battery industry is currently the fastest growing area for nickel usage. This study aims to gain support for case company's operations in the market.

The thesis consists of a theoretical part and an empirical part. The theoretical part introduces the supply chain and what it consists. Marketing is a part of the supply chain and the theory focuses a bit more into it, also covering the theory of implementing a market research. In the empirical part a market research is implemented with an online survey.

2 PURPOSE OF THE STUDY AND CONCEPTUAL FRAMEWORK

2.1 Objectives

The objective of this thesis is to get to know the industrial process and supply chain and to carry out a market research for the Chinese battery industry. The market research will be conducted in order to discover the needs and requirements the precursor manufacturers have for nickel products and if they have interest for the case company's products. The objective is also to discover what kind of market possibilities and demand there is for the case company's products in the market. The thesis first focuses on an industrial process and the phases of the process. Marketing is one of these phases and it will be studied a bit more thoroughly. After that, the thesis focuses on market research and the process of it. It will also be examined how a market research is conducted. Finally, the market research to the Chinese battery market will be conducted and the objective is to find out what kind of requirements the precursor manufacturers have for nickel products, e.g. what are the most significant impurities that the manufacturers pay attention to.

The objective of this thesis is to explain the industrial supply chain and marketing with theory and that way understand the process between raw materials and end products. By finding out the possibilities for nickel products on the Chinese market, the thesis aims to achieve support for case company's marketing.

The thesis aims to answer the following research questions:

1. What kind of market possibilities there is for nickel products in the Chinese battery market?
2. What kind of demand there is for case company's products in the Chinese battery market?

By answering these research questions the thesis aims to provide support for the case company in marketing their products on the Chinese market and to figure out the need for further study.

2.2 Conceptual Framework

Conceptual framework is needed to more easily understand and picture the thesis. The conceptual framework has been constructed with the central concepts of the thesis. The progression of the thesis, from supply chain to survey, can be seen from the figure 1.

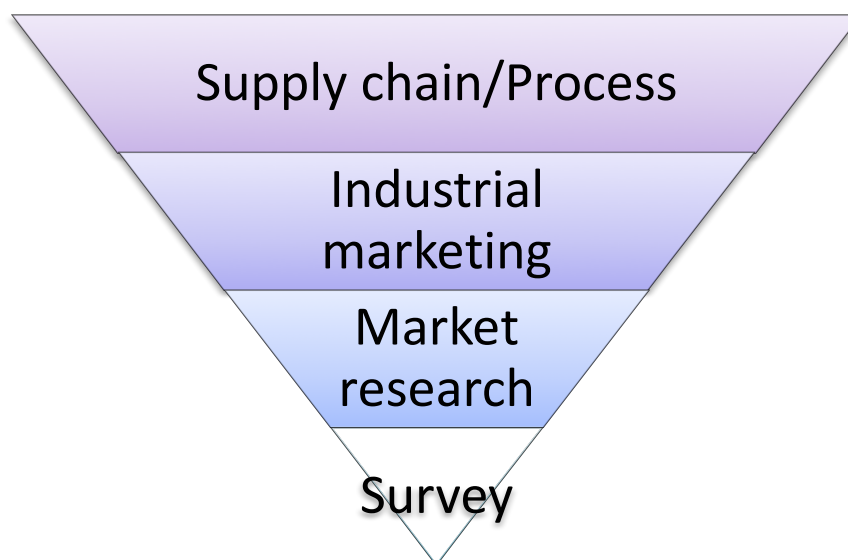


Figure 1. Conceptual framework

The thesis begins by describing the industrial process and supply chain briefly. Next it concentrates more on the business-to-business marketing, which is a part of the supply chain, after which it focuses examining market research. Finally, a market research is conducted with a survey.

2.3 Boundaries

This thesis focuses to study the case company's possible customers in China and their need for nickel products. Other Asian countries will not be included in this research. It will try to discover the most harmful impurities of nickel products for the customer, but will not study why they are harmful or what the impurities cause. The thesis will not study the possible competitors in the Chinese market or the products on the battery market, where nickel is used.

3 SUPPLY CHAIN

3.1 Definition

The supply chain consists of all the parties who participate in filling the customer's need. The parties of the chain have been presented in figure 2. The chain includes the producers, mediators, distributors, warehouses, shopkeepers and customers themselves. These parties are connected into a chain by the information, money and product flow between them. Inside a company the supply chain consists of all the functions which are made to receive and execute the customer's order. For example, on a producer, these functions can include operative functions, developing a new product, marketing, distribution, financing and customer service. (Chopra & Meindl 2007, 3 – 5.) A producer's internal supply chain is presented in Figure 3.

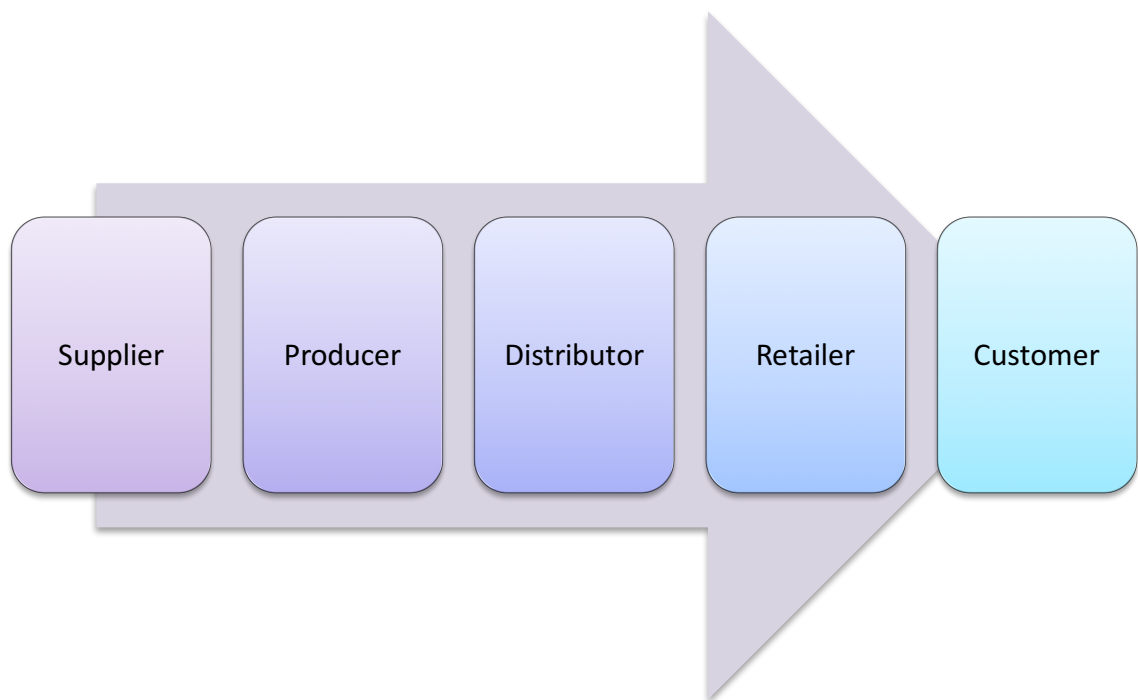


Figure 2. External supply chain (Chopra et al. 2007, 5)

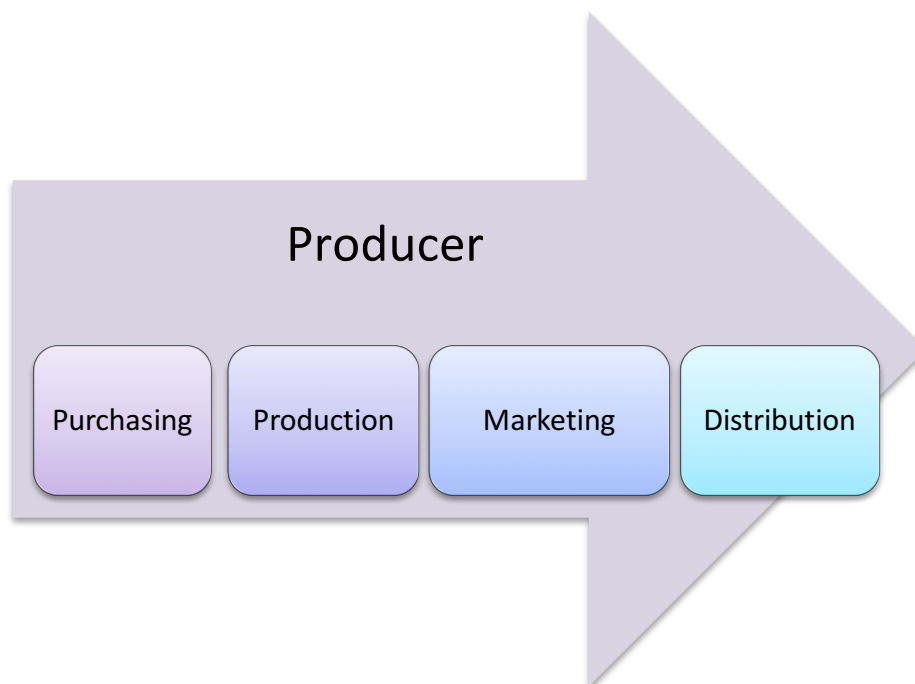


Figure 3. Internal supply chain (Chopra et al. 2007, 3 – 5)

The supply chain consists of information, money and product flow. The logistic functions, such as the transporting and handling of products, are an important part of the supply chain but the product does not move without information flow, for example without an order. The payment, money and capital flows are also an important part of the supply chain and these include for example the making and paying of the purchase invoices. (Sakki 2014, 15.) In the supply chain products go in one direction from the sources of the raw material to consumer whereas the information and the money flow go in the opposite direction from consumer to the supplier of the raw material. (Sakki 2009, 14.) A term value chain can also be used from the supply chain.

Value Chain

A value chain means the chain formed by different companies in which the product is refined into a finished product from raw material. There is also a value chain inside the company that consists of different operations of producing a product. Every stage or function of the value chain increases the value of the product. Company's internal value chain can include for example the procurement of raw materials, the refining of the raw material, production, marketing and distribution. An American

Michael Porter has developed a value chain model according to which the company consists of different value functions. These functions cause the costs of the company and produce the value of the product. The company's costs are results of these functions and they also produce the value of the product. According to Porter (Sakki 2009, 15) the value functions are divided into two main categories:

1) Primary Activities:

- Inbound logistics (E.g. Transportation and reception of incoming goods)
- Operations (E.g. Refining and production)
- Outbound Logistics (E.g. Transportation of finished products to the customer)
- Sales and Marketing
- Service (E.g. Repair service, training)

2) Support Activities

- Procurement (E.g. Company's purchases)
- Technology Development (E.g. Development of equipment and working methods)
- Human Resource Management (E.g. Employment and development of workers)
- Firm Infrastructure (E.g. the company's accounting and financial operations)

The smaller the company's costs of carrying out these functions the bigger competitive advantage it has within its branch and the bigger margin it will form. (Sakki 2009, 14-15.) Figure 4 below illustrates the value chain of Michael Porter.

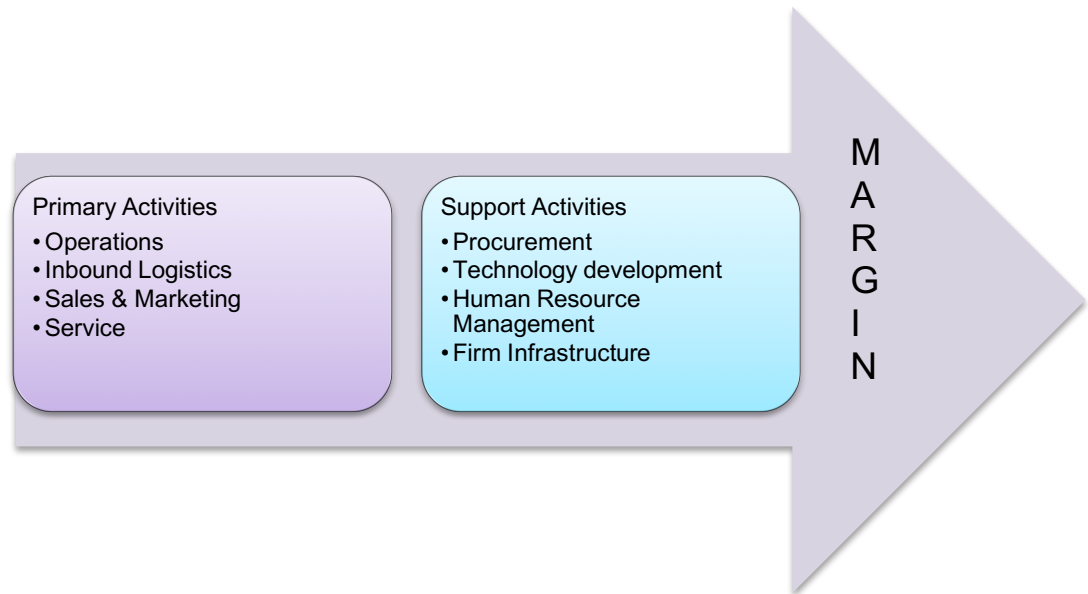


Figure 4. Michael Porter's value chain (Sakki 2009, 15)

3.2 Raw Materials

The first stages of industrial manufacturing process are surveying of the need for raw material and finding of raw material suppliers. After finding a supplier, the company investigates if the raw material requires handling, for example cleaning or refining, before the company can use it for its production. If raw material requires handling, it is decided if it will be handled by the supplier, buying company or a third party. The company can buy for example the refining from a third party. (Hokkanen, Karhunen & Luukkanen 2011, 186-189.)

The procurement process of the company consists of the identification of a need or a problem, definition of a product, search of a supplier and a product, the evaluation of offers, the selections of a supplier and an order practice and the feedback and evaluation of the performance. The company's purchasing process may start from a capacity deficit, a desire to improve performance or the pursuit of new market possibilities. After the identification of a need or a problem the company defines what kind of product they are looking for. After this the company tries to find a product and its supplier that suits the definitions. Often several alternatives are found and at the fol-

lowing stage the company evaluates the suppliers' offers and chooses the most suitable one. When the supplier has been chosen, the deliveries and payments are discussed and agreed on. After the process an evaluation of the performance is conducted. The evaluation can be formal or informal. A formal evaluation can be made by filling an evaluation form and discussing it at a meeting between a company and a supplier. An informal evaluation happens during the daily contact of the supplier and the company. (Brennan, Canning & McDowell 2011, 37-38.)

3.3 Material Handling and Production

All measures and shaping related to production that influence the physical state of the material belong to material handling. The internal transfers are also considered material handling even though they do not influence the form of material. However, they are connected to disassembling of material delivery, transferring material to production and to the packing functions of finished products. The internal transfers are handled with company's own equipment and transport is performed between different production point. (Hokkanen et al. 2011, 139-140.)

Production is a central part of the supply chain and order-delivery process and its job is to make the products that the company has sold to its customers. Products, that can be e.g. final products suitable directly for consumers or parts suitable for refining for other companies or semi-finished products, are modified from the raw materials in production using manufacturing systems. (Website of Logistiikan Maaailma 2017.) The arrangement of the manufacturing process varies depending on the field of the industry. The manufacturing processes can be divided into different production forms based on the structures. Based on these production forms, the organising of the production and the characteristics of the control can be explained. (Hokkanen et al. 2011, 149-150.)

The productions forms can be divided in three different ways. The first division is made based on the product to make-to-order production and regular production. In make-to-order production the product will be either totally or partly designed again

for every order whereas in regular production the product is nearly similar regardless of the buyer. The second division is made based on production initiative to customer oriented production and make-to-stock production. In customer oriented production, the customer's order starts the production event. Several industries strive for this. In made-to-stock production the product is made before it is sold. The products are stored and sold according to the demand. (Hokkanen et al. 2011, 149-150.)

The third division is made based on the continuity of the production process into one-off production, serial production and mass production. These divisions are separated by the value of the product, production number and recurring pace of the product. Mass production also includes the processing industry in which chemical materials are produced. These different production forms are found in many production plants as parts of the production are sold in different ways. (Hokkanen et al. 2011, 149-150.) The arrangement of the production with which the effectiveness of the production can be influenced is closely connected to the production form. Several different arrangement styles can also appear inside the same production plant and the choice of the arrangement is affected by the demands of the production and the space in use. Different arrangement styles include for example local production, production lines and production cells. (Hokkanen et al. 2011, 150-151.)

3.3.1 One-Off Production

In one-off production, one product is made at a time. The product can be unique, such as a building or have small consumption and it can deviate from the products manufactured earlier or from products that will be manufactured later. (Haverila, Uusi-Rauva, Kouri & Miettinen 2009, 354-355.) In one-off production, the product is designed based on the order to some extent but certain recurrence does appear. The production is based on flexible, computer controlled resources which can be used to make very diverse products in small series or as individual parts. (Website of Logistiikan Maailma 2017.)

3.3.2 Mass Production

In mass production, the variability of the products is small and the products are made in production lines in which the tasks are defined carefully to reach cost efficiency. The production line is able to produce products that contain a lot of variety, but one product type at a time. A new production line is often required to produce a product which deviates totally from earlier. (Website of Logistiikan Maailma 2017.) Mass production is divided into continuous production and process production. In continuous production, the product is manufactured in a continuous process. The products are piece goods meaning that they are separate and can be separated from each other. The soft drink industry is a good example of the continuous production. In the process production, the product is also manufactured in a continuous process but it is not possible to separate individual pieces of the product but the product flows between the stages. The chemical industry is a good example of the process production. (Haverila et al. 2009, 355.)

3.4 Marketing

An important part of the order-delivery process is also the marketing channel, which consists of the companies involved with the sales of the product. These companies handle the product or the information which is related to it and are between the producer and the final customer. The task of these marketing companies is to remove the possible obstacles between a product and a customer which can be for example a geographical and chronological distance. An example of a marketing company is a company which imports computers and then sells the computers in a wholesale. This kind of operation is often called business to business (B2B). (Sakki 2009, 18.)

3.4.1 Business-to-Business Marketing

Corporate marketing or B2B marketing refers to marketing of products and services, designed for corporate use, to the companies or the persons responsible for the company's purchases. This takes place between two companies and is different from marketing between the consumer and the company. Companies buy nearly the same products and services as consumers but consumers rarely buy quite the same products or services as companies. (Brennan et al. 2011, 5.) A typical supply chain includes numerous B2B events, for example companies buying raw materials to their manufacturing process (Website of Investopedia 2016).

3.4.2 Differences Between B2B Marketing and Consumer Marketing

B2B marketing and consumer marketing differs from each other on three separate areas. These areas are market structure, buying behavior and marketing method. Market structure is influenced by the nature of the demand, customer type, market fragmentation and the size of the market. Buying behavior is influenced by the trade value, the complexity of the purchasing process and the importance of human relationships. Marketing methods are influenced by the sales process, the use of human relations, branding and market research. (Brennan et al. 2011, 10-11.)

In general, it can be said that the underlying structural differences in business market and the consumer market highlight the main differences in purchasing behavior, while the differences in markets and buying behavior bring out the different marketing methods. (Brennan et al. 2011, 10-11.)

The difference is quite clear in the nature of demand. The consumer marketing answers usually to direct demand whereas B2B marketing answers mostly to indirect or derived demand. This means that the demand for the consumer can be for example bread whereas the company has a demand for flour, yeast and oil which are needed to make bread. Companies need products or services which make the production of the company's products or services possible. (Brennan et al. 2011, 2-4.)

The business market has a more heterogeneous, in other words less uniform and more fragmented customer type and it has a bigger total value than the consumer market. These characteristics reflect the huge variety of company forms which appear on the business market. (Brennan et al. 2011, 18.)

The buying process of the companies is usually more professional than the buying process of the consumers. Formal procedures and exact decision making methods are often connected to the process. In many companies a procurement manager makes the purchase decisions. In a company's buying process, the trade values can be very high and for this reason the sellers tailor their offer to be in accordance with the buyer's need. This way the sellers try to offer a complete solution to the company's problem and not a product alone as in consumer trade. (Brennan et al. 2011, 19.)

3.5 Delivery

When the final product is completed, it is transported from the factory to the customer. Nowadays companies try to concentrate on their core know-how and do not handle the transporting themselves. They use external transport companies instead. Products can be transported to the customer by road, rail, water, air or by a pipeline. The road transport has the biggest market share in Finland from the before mentioned. The market share is almost three fourths whereas in international transports, from Finland abroad, the waterborne traffic takes the biggest share. (Hokkanen et al. 2011, 84-86.) Figures 5 and 6 show the total transport distribution in Finland and internationally.

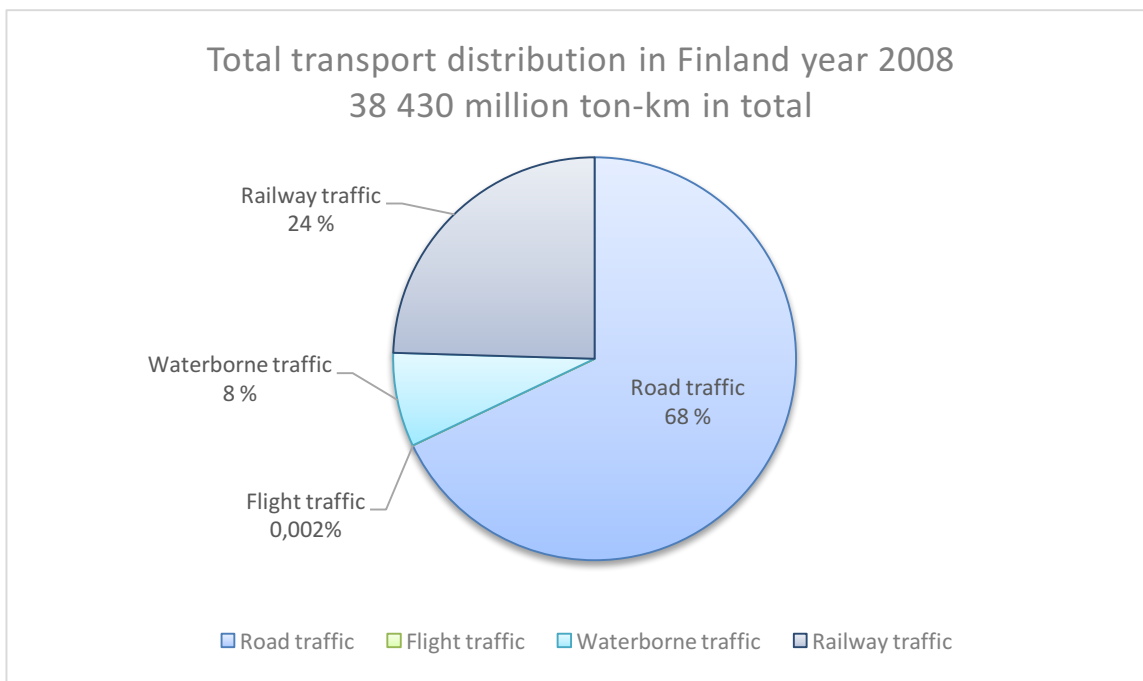


Figure 5. Total transport distribution in Finland year 2008 (Hokkanen et al. 2011, 86)

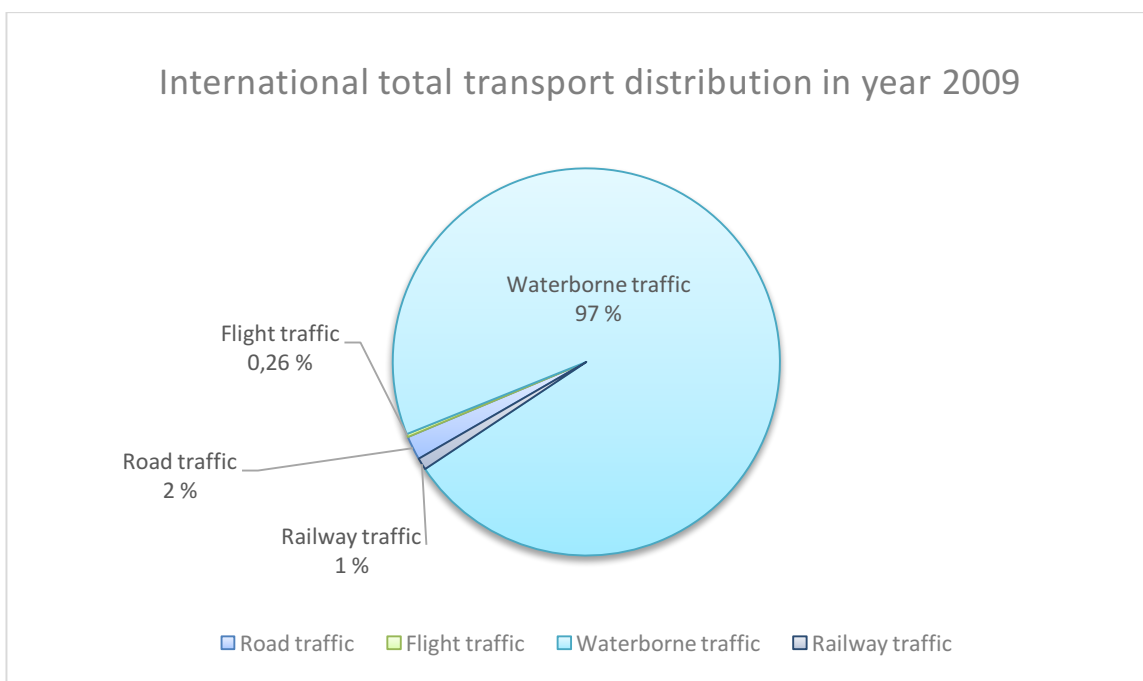


Figure 6. International total transport distribution in year 2009 (Hokkanen et al. 2011, 87)

The choice for mode of transport depends on the quality, quantity and the value of the goods, urgency of the delivery, means of communications of the shipping point, means of communications of the destination, pricing and equipment of transport

companies and legislation, for example on the transport of the dangerous material. However, the choice is usually easy to do, because the limiting factors of the goods cuts down options. Combined transports are also possible and their popularity has increased during the last few years because of cost efficiency. (Hokkanen et al. 2011, 92-93.) In combined transport at least two modes of transport have been connected in one delivery chain without moving things from one cargo space to another (Hokkanen et al. 2011, 114).

A sale also includes agreeing on the terms of delivery between a seller and a buyer when a common interpretation from the cost, damage and operational responsibilities are agreed on. In addition to the seller and buyer, the terms of delivery also apply to third parties of the trade, such as transport companies. To facilitate agreeing on the terms of delivery and to remove the risk factors especially in the international transports the international Incoterms rules have been drawn up. The contents of these delivery clauses are defined by the uniform statute book drawn up by the International Chamber of Commerce. The statute book is updated during the years, and the latest Incoterms 2010 clauses came into effect on 1.1.2011. There are 11 clauses and they clarify the cost and operation responsibility and the liability for goods between a seller and a buyer. (Hokkanen et al. 2011, 122-124.)

4 MARKET RESEARCH

4.1 Definition

A Market research combines the public, consumer and customer to the seller through information. This information is used to identify and define marketing possibilities and problems, to create marketing operations, to refine and evaluate, to monitor market performance and to understand the market process. A Market research defines the information required for the working of these matters and designs the method required for the collecting of the information. It also heads and carries out the data acquisition process, analyses the results and tells the findings and their consequences. (Website of American Marketing Association 2004.)

The most important role of market research operations in an organization is to provide reliable information to the management to facilitate decision making (Hamersveld & de Bont 2008, 37). Extensive information and perspectives helps managers to utilize even worldwide market possibilities. Problem is that the international business is full of significant risks and uncertainty due to differences in economic conditions, legal systems, physical infrastructure, business practices as well as language and culture. (Cavusgil, Knight, Riesenberger & Yaprak 2009, 35.) Market research helps managers to better understand foreign markets and develop strategies and tactics needed for success in international business (Cavusgil et al. 2009, 8).

A Market research is conducted whenever the company has a business decision facing them, for example whether they should enter a new market, what market they should target, how the product should be marketed, how the product should be developed or at the very beginning of founding a company (Cavusgil et al. 2009, 7-9). A Market research includes several different study categories depending on what is studied, for example consumer research, advertisement research, product development research, an international research or domestic research (McGivern 2013, 6).

When entering a new market, a market research is crucial in order to succeed. Before entering a new market the company managers must understand the targeted market. A market research is the perfect tool for acquiring an understanding and vital information about the country or market they are wishing to do business in. It is important that the managers understand and have information about the possible customers and competitors before they invest resources into entering the market. It is more profitable to do a market research even though the result would be not to enter the market, than make costly mistakes and poor decisions without comprehensive knowledge. (Cavusgil et al. 2009, 8-9.)

Market research can be carried out by the company's own research department, an external research company or a university. However, if external research companies are used, the research may not meet expectations. The company who commissioned the study may be dissatisfied with the results obtained or their presentation. Even if the company had guided researchers from the subject to be examined and would have expressed its hopes from the results, the researchers do not necessarily understand the significance of the study for the company or its effects on the business. However, it is recommended to use professionals when conducting a research to support the reliability of the results. (McGivern 2013, 16-18.)

4.2 Benefits

The market research helps to understand the target market and especially in international business it has several advantages. The research provides assumptions about the future that helps managers in decision making. Most of the strategic decisions of companies are based on future assumptions, like predicting a demand in a new market area. In most cases, these assumptions prove to be wrong. From market research the company receives current reports and recommendations with which the future assumptions can be updated. Current information about the markets help managers to make crucial decision regarding the value chain of today and the future. (Cavusgil et al. 2009, 10.) With the help of the research and its results, firm business plans can be planned and managers become aware of the risks and challenges and can develop

appropriate strategies and tactics. During the planning process a market research is useful e.g. in the identification and segmentation of the target market, positioning the product regarding competitors and in other relative decisions. (Cavusgil et al. 2009, 10.)

Information about competitors' product offerings, pricing methods, and distribution patterns help companies develop their own solutions. By studying the competitors' strengths, weaknesses, opportunities and risks, the company is able to plan their tactics and develop offerings that differentiate it from others. A Market research that has been well carried out produces information also about the realisation of the objectives of the company and about the direction of possible corrective actions. With the help of the market research the company can estimate the effectiveness of its value chain e.g. regarding production and marketing. (Cavusgil et al. 2009, 10-11.)

Finally, the market research improves the skills of the leaders to communicate and to negotiate with its partners and its customers and to expand the database of the company. Strong marketing skills are an important competitive advantage which improves the performance of the company whereas a stable database and sharing it leads to better decisions. (Cavusgil et al. 2009, 11.)

4.3 Process

A Market research process can be divided into different stages which vary according to the character of the study. A Typical process can be divided into three stages:

1. Planning
2. Implementation
3. Analysis

At the first stage the research problem or objective of the study will be defined and the implementation of the study is designed. (McGivern 2013, 19-20.) At this stage the limits of the study and the exact study questions will also be defined. In the study

an attempt is made to answer these questions. The researcher finds out what is already known about the subject to be examined and what kind of information she needs to solve the problem. (Cavusgil et al. 2009, 90.) The first stage is the most important of all because the results of the study are useless if they do not answer the set research problems (McGivern 2013, 14).

At the second stage the study will be carried out, in other words fieldwork is done and information is gathered. The collected information should be of high enough quality and should be connected to the questions to be examined. The information can be gathered from secondary sources of information or from primary sources of information. Usually researchers begin by gathering secondary information which somebody else has already collected. (Cavusgil et al. 2009, 92.) Books, studies and web pages are an example of this type of information. Collecting secondary information is cheaper, easier and quicker than collecting primary information. However, the information collected by others is rarely fully suitable for the research questions in hand and the information can be outdated. (Website of Management Study Guide 2016) Primary information is information the researcher has gathered herself, for example through interviews or surveys. Collecting of high quality, reliable and valid information is one of the biggest challenges. (Cavusgil et al. 2009, 92.)

At the third stage the findings made in the study are interpreted and analysed and the researcher makes conclusions based on them. A considerable wisdom and experience are needed for making the analyses and recommendations for the management. The quality of the analyses and interpretations of the information depends on the diversity and nature of the information and the available time. At the last stage, the researcher writes a report in which the results of the study are summed and the management is offered recommendations. It is important to prepare clear and suitable presentation and report, so that the results are as easy to understand as possible. (Cavusgil et al. 2009, 92-93.)

5 CASE COMPANY: NORILSK NICKEL HARJAVALTA OY

5.1 Company Presentation

Norilsk Nickel Harjavalta Oy, NNH for short, is a leading nickel chemical and nickel metal manufacturer and refiner based in Harjavalta Finland. For over 50 years, nickel has been produced at the same location, although the name and owner has changed during that time. NNH is a part of the world's largest nickel manufacturer, the Russian mining and metallurgical company MMC Norilsk Nickel Group. Over half of NNH's produce goes to Europe, about 30% goes to Far East and about 20% goes to the USA. The factory produces 50 000 tons of nickel per year and the company's turnover was 1,069 billion euros in 2011. The company employs about 270 people. The managing director Joni Hautojärvi leads the daily operations with the management team of seven. NNH's set of values consists of the responsibility for the environment and people and of commitment and renewal. The company's values guide the daily business and working. While operating, NNH wants to respect the environment and its staff and to develop itself committing to its promises. (Website of Norilsk Nickel Harjavalta 2016.)

NNH produces metallic nickel and high-quality nickel products of the high technology which have been tailored for the customer's purposes. NNH produces also nickel chemicals, like nickel sulphates, nickel hydroxides and hydroxycarbonates. Metallic nickel product groups include nickel cathodes and nickel briquettes. Nickel cathodes and nickel briquettes are used for making stainless steel to which the majority of the metallic nickel goes. Stainless steel, and therefore also nickel, is used in many different branches on a daily basis. Nickeliferous stainless steel and other nickeliferous alloys are used for example in building, bodies of the cars and motorcycles, in the preserving of foods, in chemical pulp and paper industry, hospital tools and in many other applications. (Website of Norilsk Nickel Harjavalta 2016.)

5.2 Introduction of the Process

Norilsk Nickel Harjavalta Oy produces 60 000-90 000 tons of nickel and nickel chemicals annually (The Environmental Permit of Norilsk Nickel Harjavalta Oy 2014). They produce metallic nickel, which is used as raw material in the making of stainless steel, different alloys and surface treatment purposes. The production line consists of several hydrometallurgical sub-processes, like leaching, extraction and electrowinning.(Website of Norilsk Nickel Harjavalta Oy 2017.) The process flow chart is pictured on figure 7.

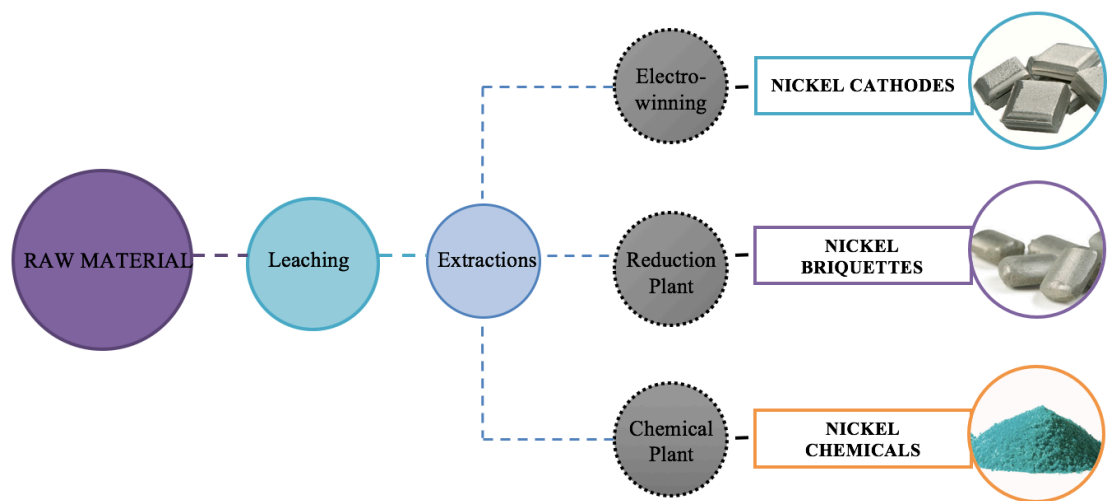


Figure 7. The process flow chart of Norilsk Nickel Harjavalta Oy (PowerPoint slideshow of Norilsk Nickel Harjavalta 2017)

The company uses nickel concentrates, nickel matte and intermediates as raw material (The Environmental Permit of Norilsk Nickel Harjavalta Oy 2014). The nickel concentrates used for raw material comes mainly from Africa, Australia and Brazil. The company's annual raw material usage is about 300 000-500 000 tons. The first sub-process that the raw material enters is leaching. (Website of Norilsk Nickel Harjavalta Oy 2017.) Nickel solution is the product of that sub-process and after removing impurities in extractions, part of the solution is piped to electrowinning and reduction plant for further processing. The other part of the solution is cleaned and pumped to chemical plant. Cathodes are grown, cut to desired size and packed in electrowinning. Briquettes are manufactured in the reduction. Nickel chemicals, like

nickel hydroxycarbonate and nickel sulphates are manufactured in the chemical plant. (The Environmental Permit of Norilsk Nickel Harjavalta Oy 2014.)

6 IMPLEMENTATION OF THE RESEARCH

6.1 Research Methods

The Research methods can be roughly distributed in two:

- Quantitative study
- Qualitative study

Quantitative study is based on facts and existing theory is often used in conducting of the research. Information is usually collected with quite a large sample size and the results are shown in numbers, tables or figures. Quantitative data can be collected via e. g. population census, sample surveys, interviews or questionnaires. Quantitative interviews are structured and consistent and all the issues are presented in the same way and in the same order in each interview. The interview can be kept face to face or for example in the telephone or online. Quantitative study has some limitations, though. Since data collection in quantitative research is structured, it is not as flexible as qualitative study, but it can be more reliable. The results of quantitative research can be superficial because of the structured and inflexible methods of data collection. (McGivern 2013, 51-52.)

Qualitative research seeks to understand the issues and aims to descriptive and profound answers. In qualitative studies, sample size is generally quite small and the results are expressed in words or in pictures. Qualitative information can be collected in various interviews, in group or alone and in workshops or by observing. The qualitative study is more flexible than a quantitative study and less arranged and free-form. Because of more free-form methods the qualitative study can be more unreliable than a quantitative study but this can be avoided with education and handling of own opinions and prejudices. A qualitative research is used in many ways, for example to develop and create ideas for advertising or products, to acquire information to assist in developing plans and strategies for business and to understand behavior. (McGivern 2013, 52-53.)

6.2 Data Collection

The data for the theory was collected via desk research from secondary sources, like books and internet sources. I tried to use current information to maintain the reliability of the research. The online sources were also evaluated based on their content and creator to be reliable. The books I used as resources for my theory were professional literature and business, logistics and process technology textbooks.

As primary data collection method, I chose the online survey. The method was chosen because it was the easiest way to reach the target of the research. The survey was designed to be structured and consistent. It was created using the Satakunta University of Applied Sciences survey tool, E-lomake and the link to the survey was sent to the respondents by e-mail. I received help in the designing, translating and sending of the survey from Norilsk Nickel's sales office.

In addition, an interview with the Head of Technical Research and Analysis Service, Pekka Alisaari from NNH, was held to find out his views on the Chinese battery industry. The online survey was used as the base of the interview. I also used an earlier research commissioned by Norilsk Nickel when collecting the data for this thesis. The research was commissioned in 2016 and studied i.a. the battery manufacturers and precursor manufacturers in Asia. In this research, they found out the battery and precursor manufacturers operating in Asia, including China. The respondents for the survey in this thesis were chosen based on the previously conducted research. This facilitated the research in this thesis since it eliminated the search of manufacturers and their contact details.

The culture in China is very different to Finland and a concern during the research was that not enough information would be received from the precursor manufacturers. Because of this the survey questions were designed to be simple and the reliability of the survey was emphasized by declaring that the survey was made under confidentiality agreement. In the beginning, a possibility of an interview with the possible customers was discussed but there would have been too many challenges. It would have been very hard to arrange the interviews because of time difference and language barrier.

7 RESULTS

7.1 Background information

The goal of this thesis was originally to implement a quantitative study. The plan was to design an online survey that would be sent to the respondents via e-mail, analyse the received responses and make conclusions based on the responses. The online survey was made and sent to the respondents, but only two responses were received. Since it was not possible to continue the research with such insufficient results, the research was amended into a quantitative study. The reason for the amendment was that a proper quantitative research could not have been implemented with only two replies. There should have been at least five replies to be able to analyse the results properly. The link to the online survey was sent to 12 possible customers near the end of February 2017 and it was open for about a month. Norilsk Nickel's sales office assisted me with sending the link to the survey for the possible customers. The sales office also sent reminders and follow-ups to the respondents during the month.

The interview with the Head of Technical Research and Analysis Service, Pekka Alisaari from NNH was held on 3rd of April 2017 in the premises of Norilsk Nickel Harjavalta. Mr. Alisaari is frequently in contact with the sales department and possible customers. He has also visited China multiple times and is familiar with the market. As a base for the interview I used the same questions as in the online survey. I also inquired him about the battery industry in general. Mr. Alisaari had a good understanding of the Chinese battery industry and since NNH already exports some products to China, he also has experience about the export process. Mr. Alisaari had not seen the results from the online survey before the interview. He also had a bit bigger expectations from the survey, but believed that in order to receive more responses, a customer relationships between Norilsk Nickel and the customer would be needed. His opinion was that the Chinese might not be willing to share their knowhow and information very easily to foreigners.

The research Norilsk Nickel had commissioned before was made a year ago in April 2016. The research was done by Avicenne and it featured a strategic analysis of the usage of nickel in the battery industry. The research demonstrated the situation of the battery industry now and before as well as future forecasts. The report of the research included 99 slides of material and Mr. Alisaari gave me the permission to access the data. The report was difficult to interpret, since it was only slides with tables and figures and no explanations. It wasn't the final report from the research. I will be referring to the research later as Avicenne research.

In the results the survey responses were compared to the interview with Mr. Alisaari and the previous research commissioned by Norilsk Nickel. Between the two received responses from the online survey and the interview with Mr. Alisaari, there were some variety in answers but overall they were still quite similar. The survey was targeted to precursor producers and as Mr. Alisaari told in the interview, the precursor producers are the company's main clientele and the most important contact point. He also explained that the precursor producers are the first step after the product comes out of a refinery or a smelting plant. In a supply chain, they are between NNH, the supplier/refinery, and the manufacturer.

7.2 Production and technology

The first questions in the online survey questionnaire were about production. Mr. Alisaari predicted that all the respondents would be precursor producers, since they were the target, but also that they may produce other products as well, although it would be difficult to say what exactly. Mr. Alisaari told that the Nickel Cobalt Manganese (NCM) is the most used technology among the Lithium Iron Phosphate (LFP) technology that was popular especially at one time. The NCM battery is a universal trend in the battery industry whereas the LFP technology is subsiding. He also told that among the most used technologies is also Nickel Cobalt Aluminium (NCA). The online survey respondents had chosen the options NCM and NCA. According to Mr. Alisaari, the most important end-use application of the battery products is the electric vehicle industry and the main clientele of the products are the electric car producers. E-mobility is a big trend in the industry and Mr. Alisaari did not consider it likely

that other end-use applications would be targeted. Among the survey respondents, both mentioned Electric Vehicle, but the other mentioned also Consumer Electronics and Energy Storage System (ESS).

The Avicenne research shows that from 2000 until 2015 the Lithium Cobalt Oxide (LCO) has had the biggest demand. LFP and NCM has had second biggest demand and both have increased significantly from 2000. The main driver applications have been mostly auto industry including electric vehicle but also smartphones and portable PCs. The forecast for the future was that the LFP and NCM will dominate the market holding over 60% of the market share in 2025. NCM will have the biggest demand and overall demand will increase by almost 60%. For most technologies, the main driver applications will be the auto industry with electric vehicle having the biggest share. The electric vehicle sales have been biggest in China from 2010 until 2015. 41% of Electric vehicle sales happen in China compared to the rest of the world. The Electric vehicle sales have grown exponentially in China and will keep growing according to the forecasts in the Avicenne research.

7.3 Production expanding

The next questions in the questionnaire were about growth and expanding. Mr. Alisaari was quite certain that all of the possible respondents would say that they were expanding their production and he threw an estimation that most would be planning to double their capacity. He also estimated that the battery industry would be continuing to grow at a 10%-20% per annum rate, the main growth driver being e-mobility. He told me that the expectations for market growth are huge in China, the government is supporting electric motoring so the potential is high. The survey respondents had the exact same expectations about the industry growth mentioning new automotive market, market demand and market trends as major growth drivers. Both respondents also had plans for expansion.

In the Avicenne research, increasing market growth is visible among the whole battery industry. The compound annual growth rate in the battery market is forecasted to be 24% for the auto industry and e-bus in China between 2015 and 2025. The de-

mand is increasing, especially in China and new materials are needed to meet the demand. The volumes of the battery industry are forecasted to increase 15% per year and the total nickel demand for batteries is expected to increase from 49 000 tons to 85 000 tons from 2015 to 2025. The Avicenne research also forecasted that the two main nickel products to be sold NCM and NCA suppliers will be nickel sulphate and nickel powder 210.

7.4 Product requirements

In the interview with Mr. Alisaari, he told me that NNH's most popular product type used in the battery industry is nickel sulphate. It is the most popular because it is so pure and the customers can easily use it on their production without processing it. Unfortunately though, it is not profitable to export it to China, even though there might be demand for it because China has 5,5% import duty on chemicals. NNH is already doing export to China, but only metallic nickel products. Mr. Alisaari told me that the Chinese producers prefer the local suppliers of chemicals because of the import duty. China has a lot of small nickel suppliers. In the survey, both respondents told that the form of nickel they use is nickel sulphate.

From the NCM types produced by the possible customers, Mr. Alisaari suggested that the NCM 622 type would be prevalent and the NCM 811 on the rise. What separates all the types from each other is the different amount of metals they consist of. The survey respondents were on a bit different path, the other mentioning NCM 622 and NCM 532 and the other NCM 111. The percentage of NCM production from their total production was around 30%.

Impurities in the products may cause problems in the producer's process or in the finished product. Nickel products can contain impurities, but they can also be refined so that the amount of impurities can be reduced to a level where they don't cause problems. In the interview with Mr. Alisaari, he told me that NNH wants to find out the impurities that are harmful for the possible customer's process so that NNH can offer them a purer product, if possible. Like said before, NNH's most popular product is nickel sulphate because it is so pure that most of the customers can use it with-

out problems. Mr. Alisaari estimated in the interview that the three most harmful impurities for the Chinese customers would be iron, copper and magnesium. In the survey responses, though, the respondents mentioned iron, calcium, magnesium and silicon.

In the questionnaire, there was a question asking the requirements the respondents have for their nickel supplier. Mr. Alisaari suggested that the most important requirement would be price and right after that quality. The rest would be in following order: delivery, payment terms, technical support and lastly after service. In the questionnaire, the respondents weren't asked to put the requirements in order, just to select the requirements they had for their suppliers. Both respondents selected all the requirements.

7.5 Image of Norilsk Nickel

When we talked about the image and recognition of Norilsk Nickel among the Chinese producers with Mr. Alisaari, he told that Norilsk Nickel is probably familiar for large number of producers, but as a producer of raw material for stainless steel and not as a producer of advanced, high-quality nickel products. This is because in Russia Norilsk Nickel produces over twice as much nickel than in Harjavalta and the majority of it goes to the production of stainless steel. NNH sends a lot of product samples to possible and existing customers and Mr. Alisaari was certain that the respondents would also want to try samples. He was partially right, the other respondent wanted to try sample of nickel sulphate.

About the competitors to Norilsk Nickel, Mr. Alisaari mentioned that the Chinese nickel producers, Jinchuan and Ji'en are probably the most used among Chinese precursor producers. In addition to the Chinese nickel producers, the Belgian Umicore, that has joint ventures in China, is also among the most used suppliers, according to Mr. Alisaari. He also noticed that one of the biggest nickel producers in Asia, the Japanese Sumitomo, was missing from the questionnaire. All, Jinchuan, Ji'en and Umicore, was among the suppliers the respondents chose as their suppliers, as Mr. Alisaari guessed, but there were also GEM, BRUNP and Yin'yi. The Avicenne re-

search suggest that the main suppliers of nickel products for Li-ion batteries are Norilsk Nickel, Jinchuan, BHP Billiton, Sumitomo and Vale. They have the most diverse product range.

All the above-mentioned results are gathered into the table below (Table 1)

Table 1. Table of research results.

TABLE OF RESULTS			
	Online survey	Interview with Pekka Alisaari	Avicenne research
Production and technology	<ul style="list-style-type: none"> - Precursor producers - NCM, NCA - Electric vehicle, but also Consumer electronics and Energy storage systems 	<ul style="list-style-type: none"> - Precursor producers - NCM, LFP, NCA most popular - Electric vehicle 	<ul style="list-style-type: none"> - LCO has had biggest demand, second LFP and NCM - NCM forecasted to dominate the market with LFP - Main driver application have been the auto industry - Electric vehicle forecasted to have the biggest market share
Production expanding	<ul style="list-style-type: none"> - Plans for expanding - Battery industry growing at 10%-20% per year 	<ul style="list-style-type: none"> - All respondents expanding - Battery industry growing at 10%-20% per year 	<ul style="list-style-type: none"> - The compound annual growth rate forecasted to be 24% for the auto industry and e-bus in China in 2015-2025 - The volumes are forecasted to increase 15% per year
Product requirements	<ul style="list-style-type: none"> - Nickel Sulphate the form of nickel used - NCM 622, NCM 532 and NCM 111 - NCM production around 30% - Impurities: iron, calcium, magnesium, silicon 	<ul style="list-style-type: none"> - Nickel Sulphate the most popular form - Chinese prefer local nickel chemical suppliers - NCM 622 prevalent, NCM 811 on the rise - Most harmful impurities: iron, copper, magnesium - Most important requirements for Ni suppliers: price and quality 	
Image of Norilsk Nickel	<ul style="list-style-type: none"> - Suppliers chosen: Jinchuan, Ji'en, Umicore, GEM, BRUNP, Yin'yi 	<ul style="list-style-type: none"> - Norilsk Nickel not familiar as advanced, high-quality nickel producer - Jinchuan and Ji'en most popular local nickel producers - NCM 622 prevalent, NCM 811 on the rise - Umicore most popular foreign nickel producer 	<ul style="list-style-type: none"> - Main suppliers of nickel products for Li-ion batteries: Norilsk Nickel, Jinchuan, BHP Billiton, Sumitomo, Vale

8 CONCLUSION

8.1 Description of the research process

The subject of this thesis was offered to me while I was doing my internship in the case company at the beginning of the summer 2016. I asked if they would have a thesis subject for me and luckily they did. First I made my plan for the thesis and found out what the company was expecting out of the research. I presented my plan, tentative table of contents and my theoretical framework in the first thesis seminar at the end of November 2016. After that I started to work on the theory part of the thesis. I gathered the data from books and from internet sources. Quite a lot of resources were available from most parts, but e.g. from market research, it was a bit challenging.

My second thesis seminar was held in the middle of December 2016, in which I presented my theory and the plans for the research, including the preliminary set of survey questions. After this I received help from case company's sales organization on designing the survey questions to better suit their needs. After we were satisfied with the questions, I received help from my friend in translating the questions in Chinese and finally the translations were checked by the sales organization. Then the questions were moved to the online survey tool, E-lomake and the link to the survey was sent to the precursor producers. We gave the producers about a month to respond. After receiving only two responses, it was decided to amend the research method into a qualitative research. After that the interview with Pekka Alisaari was held in the beginning of April 2017. After the interview, I gathered all received results and compared all together writing the results of the research. I held my final thesis seminar about a week after the interview. In the seminar, I presented the almost final thesis and received a few correction suggestions.

The implementation of the research turned out to be quite challenging. All parties involved in the making of this research were very busy and combining schedules was quite difficult. In the beginning, there was a concern that not enough responses would be received and it turned out to be accurate which caused the changing of the

research method and the research questions. Also the responses from the online survey were a bit difficult to interpret since some questions were left unanswered and the answers were quite poor. The interview with Mr. Alisaari though, was very successful and he was able to explain many things that made me also understand more the survey results.

8.2 The results

The results show that the survey responses and the answers from the interview were quite similar. They were also somewhat in line with the Avicenne research. The most different opinions were about the battery cathode technologies and which one of the technologies is the most popular. Based on the results, there is clearly a demand for nickel products in China in the following years. Like said in the results, new materials are needed to meet the demand so there is a possibility that a demand for new products will be growing. By new products I mean, products that hasn't had a demand in China before or completely new products that hasn't been produced before. The battery industry is growing at a fast pace and trends like e-mobility increases the demand for products like electric cars, which increases the demand for nickel products used in the batteries of electric cars. Also the market share for other applications in the battery industry, e.g. smart phones, e-bikes etc. are expected to grow in the upcoming years. There seems to be also a demand for Norilsk Nickel's products and I think that especially nickel sulphate would have quite good demand. Unfortunately, the only downside seems to be the import duty.

Because of the low response rate, the research questions had to be amended a bit. In the beginning, the goal was to find out what kind of requirements and needs the precursor producers have for nickel products, but since the response rate was so low, a proper analysis could not be made. The both respondents answered to the questions regarding the impurities in the nickel products but the answers were poor. In order to receive reliable and valid data about the impurities, more questions and more answers would have been needed. Because not enough of data could be gathered about the requirements and needs the producers have, the research question was amended

to find out the possibilities the case company's products have on the Chinese battery market.

Since NNH already has some operations in the Chinese market it is quite easy for them to collect information and update their forecasts. More answers may have been received if a face-to-face interview or discussion with the customers would have been possible since the Chinese culture values personal relationships and it is a custom in China to build the personal relationship first and only then do business.

8.3 Recommendations for further study

Since the original goal of this research was not completely met, I would suggest that another research would be conducted about the same subject. I think that it would be wise to arrange interviews or attend a fair in order to meet the people face-to-face and be able to have a conversation about the topics. I think this would be more profitable because the topics are quite complicated and in order to get a better picture of the markets, simple survey questions don't seem to be enough. I think it would be more profitable also because that way the company could build their relationships with the producers and they could be more open to discuss the topics that may be a bit sensitive.

The low response rate shows that possibly the case company could be more recognisable in the market or that perhaps they should invest on the relationships more. As Pekka Alisaari also told that Norilsk Nickel probably is known better as a producer of raw material for stainless steel, they could somehow try to increase their marketing of the high-quality nickel products. Since it is a custom in China to first get to know the business partner well before doing business with them, I would suggest that Norilsk Nickel Harjavalta Oy should invest on the relationships with the Chinese precursor producers. It might also be better if the questions presented in the survey would come straight from NNH and not from a third party. That would increase the reliability.

8.4 Validity and Reliability

The trustworthiness of a scientific research is usually observed through two concepts, validity and reliability. By estimating the validity and reliability of a research, the researcher aims for results that are accurate and correct. It is estimated that right choices have been made in different stages of the research and the solutions have been justified. (Kananen 2015, 343.)

The reliability of the study means that if it were done a second time, the results would be the same. The reliability of a study can only be estimated, since doing the research a second time would be costly and difficult. The reliability of a study doesn't guarantee the validity of a research. The research can be done many times and receive similar results, but the results might all be wrong. This would mean that the reliability of the research is high, but the validity is low. (Kananen 2015, 349-50.)

The validity of a research means that the right subjects have been studied. The validity can be divided into internal validity and external validity. In internal validity the researcher must be able to prove her arguments correct and justify her solutions. The external validity means that the results are accurate also outside the research. (Kananen 2015, 347.)

The reliability of the research done in this thesis is estimated to be rather good. The research can be made in the same way that it is made now, if all the same information is received. During the research, I was working in Norilsk Nickel Harjavalta Oy and had access to their database, so a person not having the same information available, might not be able to repeat the research in exactly the same way. Since we did not receive enough responses to implement a quantitative study, like the plan was, the material I received from NNH had a much more important role. It is also possible that the amount of responses might change if the research was repeated. The amount of responses might vary depending on who is doing the research.

The validity of the research conducted in this thesis is also estimated to be rather good. The samples that were studied were chosen based on the research problem. The company wanted to gain information about the battery and precursor manufac-

turers in China, so only Chinese manufacturers were chosen. The questions on the online survey were also designed to answer the research questions. The questionnaire includes also some questions that were not used in this thesis, but were relevant to the company.

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Questionnaire about Precursor Raw Material

The information from this questionnaire is used for market research in a University thesis about the battery market in China. The thesis is conducted by a student of Satakunta University of Applied Sciences for Norilsk Nickel Harjavalta Oy in Finland. The research is done under a confidentiality agreement and no data will be revealed to third parties. The information will be limited in a manner that it is not possible to separate any single company from the results.

Norilsk Nickel Harjavalta Oy
Teollisuuskatu 1, 29200 Harjavalta
www.nornik.fi

Basic Information	
	Write your information below
Company Name	
Interviewee Name	
Title	
Interviewee Contact Number	
Email	
Company Address	
Company Website	
Section 1. Production	

1. What product(s) do your company produce?

- Battery Cathode
- Precursor
- Battery Anode
- Electrolyte
- Others..

Please Specify:

2. If you produce battery cathode, what technology do you use?

- LFP (Lithium Iron Phosphate)
- LCO (Lithium Cobalt Oxide)
- LMO (Lithium Manganese Oxide)
- NCM (Nickel Cobalt Manganese)
- NCA (Nickel Cobalt Aluminium)
- Others...

Please Specify:

3. What end-use application(s) do your battery products serve mainly?

- Consumer Electronics

- Electric Vehicle (EV)
- Energy Storage System (ESS)
- Others...

Please Specify:

4. As the supplier to customers in the above applications, what are the major requirements from your customers?
- Quality
 - Price
 - Delivery
 - After service
 - Payment terms
 - Technical support
 - Others...

Please Specify:

5. Do they certificate the raw materials of your products?
- Yes, Please specify what standard they use below
 - No

Please Specify:

6. Do you expect the battery industry to continue grow? What's your estimate on the growth rate in the next 5 years? And what's the main growth driver?
- ≤5% p.a.
 - 5%-10% p.a.
 - 10%-20% p.a.
 - 20%-30% p.a.
 - >30% p.a.

Major growth driver(s):

7. Do you have any plans to expand production in the next 5 years?
- Yes
 - No

If yes, please provide more details

	Write below
Expansion location	
Designed capacity	
Product scope	
Total investment	
Estimated commission	

Section 2. Raw Material Procurement

8. If you produce precursor, how much tonnage do you produce in 2016? What type(s) of NCM do you produce and what's the percentage of each type in your total production?

APPENDIX 3

Total production of precursor (kt) among which,

- NCM 111 (%)
- NCM 532 (%)
- NCM 622 (%)
- NCM 811 (%)
- Others (please specify)

9. What is approximately the quantity of nickel needed in your process? Which form of nickel products do you use?

	Total consumption of Nickel (kt) among which,
Ni Sulfate (%)	
Briquettes (%)	
Powder (%)	
MHP (%)	
Others (please specify)	

10. After you purchased above nickel products, how do you process them?

- Dissolving
- Leaching
- Extracting impurities
- Others...

Please Specify:

11. Do you mind telling us who are your suppliers of nickel products? If not, are they local producers or ex-China producers?

- Norilsk Nickel
- Vale
- BHP Billiton
- Glencore
- Ramu (Minmetals)
- Ravensthorpe (First Quantum)
- Jinchuan
- Ji'en
- Yin'yi
- Umicore
- GEM
- BRUNP
- Others...

Please Specify:

12. What are your major requirements to your suppliers?

- Quality
- Price

APPENDIX 4

- Delivery
- After service
- Payment terms
- Technical support
- Others...

Please Specify:

13. Do impurities in nickel products cause problems in your production? What are the three most harmful impurities and what types of problems do they cause?

	Top 3 harmful impurities	Problems caused by impurities
1.		
2.		
3.		

14. How do you order the nickel products?

	Average volume per order (tonnes)	Frequency of order placement	Normal stock (tonnes)
Ni Sulfate			
Briquette			
Powder			
MHP (Mixed Hydroxide Precipitation)			
Others (please specify)			

15. Are you familiar with Norilsk Nickel?

- Yes
- No

Please specify how you know Norilsk Nickel:

16. Are you interested in trying any nickel product samples from Norilsk Nickel?

- Yes
- No

Please specify what type of nickel product:

17. If you do NOT produce precursor, do you mind telling us who are your precursor suppliers and any contact person for our further contact?

	Precursor supplier	Contact person	Contact number
1.			
2.			
3.			