

OULUN YLIOPISTO
UNIVERSITY of OULU

FACULTY OF TECHNOLOGY

Channels to Mining Industry and Technology Market

Kimmo Mantila

Master's thesis

Department of Process and Environmental Engineering

September 2013

Department		Degree programme	
Department of Process and Environmental Engineering		Process Engineering	
Author		Thesis supervisors	
Kimmo Mantila		Hannu Kuopanportti and Juha Taskinen	
Title of thesis			
Channels to Mining Industry and Technology Market			
Major subject	Type of thesis	Submission date	Number of pages
Process Engineering	Master's thesis	September 2013	59 p + 4 app
Abstract			
<p>This research is a Master's thesis that has made for Parker Hannifin Oy in the University of Oulu in Department of Process and Environmental engineering. Parker Hannifin Oy ordered a market research of the Finnish mining market. A subject was a limited research to the northern Fennoscandian and Greenland mining market but the main focus is in Finnish mining industry and technology market. The research produced new information about the mining market for the decision makers of Parker Hannifin Oy. The research problem was to clarify which delivery models would work with mining industry, what is the commercial potential with mining industry and which are the technology areas where the supply of Parker Hannifin Oy and the demand of the mining industry would meet.</p> <p>Qualitative and quantitative methods were used in the market research. A sample for market research was collected from public sources and with interviews and questionnaires. The market research begun with desk research in which the researcher investigated the mining market by public information. After this there were a qualitative interviews and questionnaires for the mining industry and for the company which ordered of research. The data sample was treated with qualitative research methods.</p> <p>The commercial potential for Parker Hannifin Oy is huge in Finnish and Swedish mining market. The mining is developing and growing very fast in both countries. It was estimated that Parker Hannifin Oy could be increased their revenue 10 % by sales to Finnish mining industry in 2012. It has been estimated that the production of Finnish mining industry will triple by the year 2022. Also, the Swedish mining industry will need 10 000 – 15 000 new employees by year 2025 which two or three times more than Finnish mining industry. The potential mining industry customers considered that site container and a spare part store of mining company are efficient and effective delivery models. One result of the questionnaire was that most of the Finnish mining companies have a store of critical spare parts of mining machines. Products of Parker Hannifin Oy are mostly used in underground mining machines in Finland. In the research came out that the easiest way for Parker Hannifin Oy to increase its sales could be by finding cooperation partners from those local stores and contactors which already do business with local mining companies.</p>			

Contents

ABSTRACT	
1 INTRODUCTION	5
2 MARKET RESEARCH IN THEORY	6
2.1 Business to Business Market Research	6
2.2 What is the Market Research?	6
2.3 Market Research process	8
2.4 Schedule of the Market Research	9
2.5 Market Research tools	9
2.5.1 Desk Research	9
2.5.2 Depth Interviewing	10
2.5.3 E-based questionnaires	11
3 RESEARCH	13
3.1 Research in practice	13
3.1.1 Desk Research in practice	13
3.1.2 Parker interviews	13
3.1.3 Parker questionnaires	14
3.1.4 Finnish mining industry interviews	16
3.1.5 Finnish mining industry questionnaires	17
3.2 Fennoscandian shield	18
3.3 Finnish mining industry	19
3.3.1 Metal ore mines in Finland	20
3.3.2 Industrial mineral mines in Finland	28
3.3.3 Mining projects and investments in Finland	32
3.3.4 Finnish mining industry stakeholders	35
3.3.5 Finnish mining market specificity	39
3.4 Other mining industry in the North	40
3.4.1 Norwegian mining industry	40
3.4.2 Swedish mining industry	41
3.4.3 Greenland mining industry	42
3.5 Evaluation of research methods and results	43
4 CONCLUSIONS AND RECOMENDATIONS	45
5 SUMMARY	50
REFERENCES	53
APPENDIX 1	
Questions for interviews of Parker Hannifin Oy	

APPENDIX 2

The questionnaire for Parker Hannifin Ltd

APPENDIX 3

Questions of interviews for a Finnish mining industry

APPENDIX 4

Questions of questionnaires for the Finnish mining industry

1 INTRODUCTION

This research is a Master's thesis that has been made for Parker Hannifin Oy in the University of Oulu in Department of Process and Environmental engineering. Parker Hannifin Oy is part of international Parker Hannifin Corporation. The main products and technologies of the company are aerospace, climate control, electromechanical, filtration, fluid & gas handling, hydraulic, pneumatic, process control and sealing. At the present it is expanding its business to mining industry internationally. This Master's thesis provides market information about the mining industry for Parker Hannifin Corporation.

The purpose of the research was to create a clear picture about northern of Fennoscandian and Greenland mining market for Parker Hannifin Oy. The aim of the research is to get information of mining market opportunities and threats. This market research provided information of the mining industry and technology market for the decision makers of the Parker Hannifin Oy. The market research helps and supports decisions.

The problems of research are questions which are:

- 1. What is the potential in northern of Fennoscandian and Greenland mining and technology market for Parker Hannifin Oy?*
- 2. What are the best delivery and marketing channels for the mining and technology market?*
- 3. What are those technologies and mining industry areas where the supply of Parker and the demand for mining industry face the best?*

In the research answers to those questions by qualitative and quantitative research methods have been sought. The research data has been collected by a desk research, interviews and questionnaires. An extensive description of the northern Fennoscandian and Greenland mining and technology market has been obtained by these research methods and tools for the research. This Master's thesis gives an opportunity for a reader to explore the market research theory, the mining and technology market.

2 MARKET RESEARCH IN THEORY

In this chapter market research theory and tools are presented. Theory study is focused on those methods which have been used in this market research. There is a short review of literature which explains what the market research is. The tools of market research are introduced at the end of the chapter which has been used for data collection.

2.1 Business to Business Market Research

This market research is typical business to business market research. The target sample of research is mining industry which in this case is customer or consumer. The research has been ordered by a company which wants to expand its business to mining industry. Market research handbook tells us that there is no clear definition for business to business market research but b-to-b market research investigates opportunities and ways of markets for commerce and business. (McPhee 2008, 251.) Basically the main difference between consumer research and b-to-b research is the size of the sample. B-to-b research is focusing on smaller target group. The research tools are approximately the same in both methods. (McPhee 2008, 251; Hague, Hague & Morgan 2004, 7.)

The sample on business to business market research comprises of people who make or effect on decisions, buy services and goods. Those decision makers can be employers or supervisors or managers or such as the owners of the company. Stakeholders can influence big decisions in some companies or investment projects. (McPhee 2008, 252-253.) The role of researcher is very important in business to business market research So that basically the researcher is a gatekeeper of the project. The researcher is responsible for market research design and he or she will bring together the expectations and requirements of research for the company which ordered the research. (McPhee 2008, 253.)

2.2 What is the Market Research?

Market research is a tool for the managers of a company which will help they make better decisions. Basically market research investigates human behavior and the researcher will try to find a way to describe this behavior. The market researcher should recognize and identify the core issue of the problem. Another important skill for the

researcher is capability to separate research planning and data collection. The market research is always an unique activity and that is one of the reasons why the most important steps in the research process are defining the problem and planning the research. Definition of market research should be clear and simple. The most common type of market research is to describe work as quantitative or qualitative research. The simplest quantitative research is to use structured questions with large samples. The qualitative data collection could be carried out by unstructured question or discussion groups where it is possible follow up new ideas. Structured data are easier to handle because statistical computer programs can be used. (Phillips 2008, 37-40.)

A quantitative market research is a way to get feedback from customers for the company. Quantitative research methods give a change to take larger samples and that is the essence quantitative research. (Phillips 2008, 40.) In quantitative research the sample size should be at least 200 questionnaires or interviews (Hague et al. 2004, 16). That kind of research proves and investigates results by numbers. Typical tools that those researches use are structured interviews, phone interviews and questionnaires. All those tools have several risks, for example the interviewee can be shy and nervous about the recording of an interview and that nervousness may affect answers. Second risk in interview is that interviewer can be led by the respondent and that would affect answers. Risk in questionnaires is misunderstanding. The researcher cannot be sure whether the respondents understood the questions correctly. Also in quantitative market research the most important step is design and definition of research. (Phillips 2008, 40-41.)

A qualitative market research is much more complex research method than quantitative market research. Usually the results of qualitative research are not as scientific or complex than the results of quantitative research. (Phillips 2008, 41-42.) Qualitative market research is much harder to define with one sentence than quantitative market research. The emphasis of qualitative market research is on understanding rather than measuring. That research is interested in understanding of how the consumer perceives the product, brand or other marketing object. Qualitative market research is also interested in the motivations of customers. (Hague et al. 2004, 10.)

Qualitative and quantitative market research are mostly complementary. That is why it is reasonable to use both methods in the research. Qualitative methods can increase the value of the quantitative market research. The qualitative market research can help to

understand deeper the market than basic statistics which can be the result of quantitative research. Usually the qualitative research methods are used in the beginning of research because it would provide information to question what is wrong in the market. Knowing the answer to that question makes easier to do larger scale quantitative market research and focus on the main problems. (Hague et al. 2004, 11.)

2.3 Market Research process

The book *Market Research in Practice* (Hague et al. 2004, 11) recommends that a design for a market research process is as follows: systematic collection, analysis and interpretation of information which is relevant to marketing decisions. The market research process is illustrated in figure one.

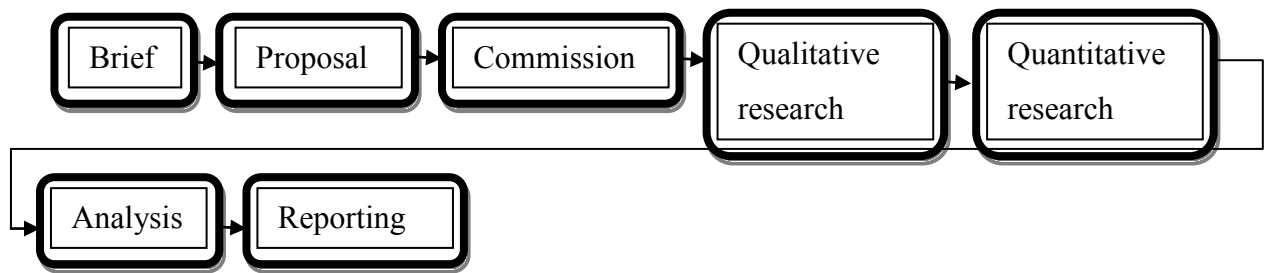


Figure 1. The market research process (Hague et al. 2004, 12.)

The market research begins by a brief. The purposes of the brief are talk about the background of the project and clarify what are the key issues that the customer which ordered the research expects from the results of the market research. What managers wish to know before they make the decisions of expanding or other important decisions? Proposal is a point in which the market researcher presents the research plan for the customer. This is really an important step of process because if well executed the research plan helps to prepare the research itself. There are methods that can be used for data collection in the research plan. That is important because it gives a picture of research costs and resources that will be needed. When the research plan has been approved the data collection begins. This is a first visible part of market research. That will have many interviews and questionnaires. Data that have been collected will be analyzed and aggregated to the final report. The purpose is to provide a clear description of markets for the final report. Then the decision makers can use the report to help them in their decisions. (Hague et al. 2004, 12-13.)

2.4 Schedule of the Market Research

A typical timetable of the market research is shown in table one. This picture shows that in the market research timetable is really tight. This example research begins by qualitative methods such as focus groups and later some quantitative methods will be used such as questionnaires. It is important to make this kind of timetable for the market research because it will help tracking of the research process and it will assess to the completion of research. (Hague et al. 2004, 26-27.) Timetable also helps researcher to stay on schedule.

Table 1. a Example timetable of the market research. (Hague et al. 2004, 28.)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Commissioning meeting										
Focus group recruitment										
Focus groups										
Qualitative debrief										
Questionnaire design										
Sample composition										
Fieldwork										
Analysis										
Presentation development										
Presentation										

2.5 Market Research tools

This chapter will present market research tools which have been used in the research. There are a lot of different kinds of tools that could be used in market research but in this research have been used desk research, interviews and questionnaires.

2.5.1 Desk Research

There is always some level of prior information available on previous researches on the subject. There is no point to reinvent the wheel. It makes sense to use the results of previous research for a market research. It is not always profitable to spend resources and money for primary research especially if there already is information on subject. The main point of desk research is to provide cheap or free information on subject. (Hague et al. 2004, 33.)

Desk research is a term that generally means that the researcher refers to secondary data which has been collected for some similar research. This could be some old sales or

market statistics which have been forgotten in desk drawers. There are lots of good sources on the internet which provide market intelligence for free but Internet sources should be evaluated critically. Municipal and university libraries, too, are good places to find sources. In most of the desk research cases the researcher is looking for statistical quantitative data. The best sources which provide this kind of data are governments. European Union statistical data is provided by Eurostat. (Hague et al. 2004 , 33-42.)

There is lot of market research areas which can be investigated by desk research. Marketing environment, market structure and size can be studied. It is often possible to estimate and study these issues by data that is provided by governments. Desk research can also include information on suppliers and brands. The first source for information of the supplier and brands is obviously company website. This information can also be looked from press such as trade journals and company accounts and published reports. (Hague et al. 2004, 42-44.)

2.5.2 Depth Interviewing

Depth interviewing is not an ordinary interview. It is more like a deep conversation about the main topic. The point of depth interviewing is that the interviewer and the interviewee discuss and clarify the alternative perspectives of the topic. Interviews are usually loosely structured which allows freedom for the interviewer and the interviewee to explore additional points and change direction if necessary. The depth interviewing is a strongly qualitative method. (Hague et al. 2004, 60-61.)

Depth interviewing is carried out normally by face-to-face interviewing because it will allow monitoring the body language and reactions of the interviewee when he or she replies to the questions. This is of real importance in qualitative research. Depth interviews are a very useful method in market research especially when the research issues are not well known; there is need to explore issues, needs and motivations; there is need to describe processes which are very detailed; complex explanations and understanding is required; there is need to test new products and evaluate how people react; there is a need to avoid contamination between the opinion of interviewees. That last sentence means that one should choose a research situation which is better for research depth interviewing or focus groups. (Hague et al. 2004, 61-62.) This research

does not have a focus group which is one method of data collection because it was not possible to use it in this research.

The book *Market research in practice* tells us that ten depth interviews are enough for market research but in 30 depth interviews is needed to solve every aspect of research topic (Hague et al. 2004, 63). The data analysis is very difficult on depth interviewing and it takes up a lot of resources and costs especially when the number of interviews rises near 30. One problem in depth interviewing is to find volunteers to be interviewed when market research is prepared for a company which has other companies as its main customers. The problem is emphasized particular to a new market study because those potential respondents may feel there is no benefit for them to answer. (Hague et al. 2004, 64-65.)

The depth interview process consists of four sequences. Interview begins by introduction and after that interviewer will ask some warm up questions. Then the interviewer will change the topic to the main problem and asks questions about it. The interviewer will close the interview session by thanking the interviewee. This kind of body of the interview helps to create casual atmosphere. It is always very important to follow the behavior and body language of interviewee as those will tell when it is time to go on or ask more specific questions. (Hague et al. 2004, 68-69.)

2.5.3 E-based questionnaires

Internet based questionnaires are very cheap and quick way to collect market research data. The questionnaire can be delivered by email. There are many programs on the Internet with which questionnaires can be made and replies to questions analyzed. There are also problems with the Internet based surveys. First problem is that everyone does not have access to Internet which means that research sample will have only people who do have the access. Second problem is that it may be surprisingly difficult to deliver the questionnaire if an email list is not previously collected. The email address must be written correctly and that can also cause problems. If the email list is not available already, it is a reason to think twice the usability of the e-based questionnaire. (Hague et al. 2004, 156-158.)

However, the e-based questionnaire is an ideal survey when the market research is about customer companies because they have nearly always access to the Internet. The benefit of the e-based questionnaire is that it does not need a great number resources and time from respondents. One researcher can do very extensive research in a couple weeks with e-based questionnaires and that is the best thing in this method. SPSS and Microsoft Excel are good tools for a analyzing of results. However, the researcher should know that the level of response is usually very low in e-based questionnaires. The typical good respond level is two to five percent. (Hague et al. 2004, 157.)

3 RESEARCH

The market research results of the northern Fennoscandia and Greenland mining industry and technology market are presented in this chapter. At first research methods are introduced and especially how those have been used in the research. After this, all market research results are presented. All results of different research methods have been collected to one report because it helps a reading and understanding of results.

3.1 Research in practice

The market research began by desk research in which the researcher investigated the mining market by public information. After this there were a qualitative interviews and questionnaire to the mining industry and the company which ordered of research. The main data collection was performed with online questionnaires which were sent for the widest possible sample. Questionnaires were different for different respondents.

3.1.1 Desk Research in practice

The purpose of desk research is to get information of the main research problem which is incomplete information about the mining market in this research. This information allows starting the design of interviews and questionnaires for mining industry and company which ordered of research. The aim is to study about companies which are on the mining market now and what kind of projects and explorations there will come in the near future on mining industry. The focus in the study is on metal ore mines and industrial mineral mines in the Finnish mining industry. The research includes information about annual number of ore mining tons, all mining tons, subcontractors, stakeholders, mining technologies and equipments of mining companies. All this part of research is based on public sources such as websites of companies and statistics from the government. Desk research is based on secondary data.

3.1.2 Parker interviews

For the research five specialists of Parker Hannifin Oy and one mining sale specialist of Parker distributor were interviewed. Distributors are retailers of Parker products. Interviews were organized in an office of Parker in Vantaa, in Oulu University and in an

office of Parker distributor in Kajaani. All those interviewed people are already connected some way to mining industry. Open questions were used in interviews but those situations were more like conversations and all interviews were private situations. The aim of the interviews was to clarify what kind of information employees of Parker need from potential mining industry customers and what they are expecting from this market research. This information from interviews was used for mining industry market research planning especially interviews planning. Questions of interviews are in appendix one.

All interviewed Parker specialists mentioned mining machines. They would like to get more information directly from mines which are using mining machines. What is good now in mining machines and what the mining industry expect in the future for mining machines. Also, the employees of Parker were interested in what kind of big problems mines have today? What are the weaknesses in which they need development and support in mining industry? They would like to know what service and contract systems mining industry prefer? Is it local support and private services for the mines or wide global co-operation contracts? What kind of spare parts supply system would be workable for mines? Most of interviewed people mentioned that they would like to know how much the mining industry is really investing in energy saving systems, environment saving systems and electronic mining machines.

3.1.3 Parker questionnaires

Questionnaires were sent for the international mining specialists of Parker Hannifin Corporation. The aim of the questionnaire was to clarify how Parker Hannifin had organized their operations earlier with the mining industry and how the business actually works with mining companies. Also, there were questions about the main products of Parker and supply channels for mining industry. One question tried to clarify what kind of trade or co-operation in the world there is between Parker Hannifin and those mining and exploration companies which currently operate in Finland. Questions of questionnaire are in appendix two. The questionnaire was sent by email for the international mining market developing team of Parker. There were replies to the questionnaire from one person from Parker Australia, one person from Parker United States and one from Parker Sweden.

The respondent from the US works in hose product division of Parker. Their business with mining industry is based on hose products in that division. The trades to mining industry generally are carried out by original equipment manufacturers (OEMs) and specific mining distributors. Parker mining distributors provide spare parts and services locally for mining companies. The distributors have very close relationships with their customers and they can provide customized services for their local mines in the US. Coal mining industry is one big special customer in the US. For the products in the US coal mining industry has some specific safety requirements. The respondent estimated that in future the mining industry expects more local and immediate services and the safety will grow in importance in the mines. The MSHA approvals of products will be more critical argument.

The respondent from Australia is a mining market manager of Parker. He told that Parker provides all Parker products for original equipment manufacturers (OEM), maintenance & repair organizations (MRO) and directs to mining companies in the mine market in Australia. Also, they provide support and service for all products in the mine market. The main businesses in the mine market are in several product areas: hydraulics, fluid connectors, filtrations and automation. Parker distributors handle the sale to smaller OEM and MRO customers. The Parker has contracts with larger OEMs and with some major mine sites about the direct supplying in Australia. The Parker has site container trade with Anglo American Plc in Australia. That company has an exploration project in Sakatti, Sodankylä. The respondent estimates that in future original equipment manufacturers which produce mining machines with focus more on autonomous operation, machine availability and reliability. This is the trend and one reason is that the productivity of mines has fallen over the past ten years in Australia. The mine companies have to find solutions for this problem.

The respondent from Sweden is a key account manager of Parker. He told that he is mainly responsible for two original equipment manufacturer customers of Parker. The main product areas that Parker provides for OEMs in Sweden are hydraulic components, filters and fluid connectors. The Parker has mainly three kinds of customers in Sweden which are hydraulic equipment distributors, systems integrators and serial production OEMs including aftermarket organization. Parker Hannifin does not have direct supply contracts for mines in Sweden. The respondent did not know if there is any co-operation or business in Sweden between Parker and those mining

companies which operate currently in Finland. He estimates that in the future the production of mining machine OEMs will move more and more to Asia. OEMs will focus on environment, fuel efficiency and remote control in mining machines. OEMs have increased their aftersales business with mining companies in past few years.

The respondent from Sweden is a account manager of Parker. He told that he is mainly responsible for two original equipment manufacturer customers of Parker. The main product areas that Parker provides for OEMs in Sweden are hydraulic components, filters and fluid connectors. The Parker has mainly three kinds of customers in Sweden which are hydraulic equipment distributors, systems integrators and serial production OEMs including aftermarket organization. Parker Hannifin does not have direct supply contracts for mines in Sweden. The respondent did not know if there is any co-operation or business in Sweden between Parker and those mining companies which operate currently in Finland. He estimates that in the future the production of mining machine OEMs will move more and more to Asia. OEMs will focus on environment, fuel efficiency and remote control in mining machines. OEMs have increased their aftersales business with mining companies in past few years.

3.1.4 Finnish mining industry interviews

The purpose of interviews for Finnish mining industry was to collect deeper and more detailed information given by companies, how they have organized their maintenance, who their stakeholders are and what kind of future missions and investments they have. The interviews were organized in the offices of interviewees. All interviews were recorded which speeded up interviews. The results of interviews are included in the chapter 3.3 Finnish mining industry. The results of desk research and interviews helped to define questions for questionnaire and that was a one goal of Finnish mining industry interviews. People that have been interviewed for the research are employees of mining companies and subcontractors. Interview questions are in appendix three. The interview questions were open questions. Questions were changed by an interviewee so that there were different questions for the mining companies and mining subcontractors. The interviews were more like conversations and the interviewer just control the interviewing situations with questions. The interviews for Finnish mining industry were not as private situations as the interviews for Parker employees. In the mines of Kemi and Pyhäsalmi there were two people in the interview situation who answered for

questions. That was good because conversations were more thorough in those mines. Interviews took from 15 minutes to 40 minutes. In total there were four interviews for mining companies and two for subcontractors. Interviewed mining companies are Mondo Minerals B.V (Sotkamo), Agnico-Eagle (Kittilä), First Quantum Minerals (Pyhäsalmi) and Outokumpu Chrome (Kemi). Interviewed mining contractors are E.Hartikainen (Sotkamo) and Toivanen (Kemi).

3.1.5 Finnish mining industry questionnaires

The main market information collection was planned to be carried out by questionnaires for the Finnish mining industry. Questionnaires have designed with the results of desk research and interviews and questionnaires which had organized for the specialists of Parker and Finnish mining industry. The purpose of the questionnaire for Finnish mining industry was to collect that kind information of mining industry which is not published already and that way collect valuable market information. Questionnaires are in appendix four. There are three different kinds of questionnaires one for mining companies which currently operate in Finland, one for mining and exploration companies which have mine projects in Finland, one for mine subcontractors and one for original mining equipment manufacturers. Questionnaires were made with a questionnaire design program SurveyMonkey and the web link was sent for respondents with email. That email also included introduction about the research and the Master's thesis and in the email was mentioned that Parker Hannifin Oy has ordered the market research. In the introduction of the email it was asked to be forwarded the email in the company if the questions were not proper in the field of the respondent. Questionnaires were sent to 16 people who represent mining companies, for five people who represent mining projects, 13 people who represent mine subcontractors and for two people who represent the original mining equipment manufacturer. All those people are some way connected with mining industry and maintenance. The email and link for the survey were sent two times to the respondents. The second time that the e-mail was sent was a reminder message of the research and was sent two weeks after the first e-mail. It was not possible to accurately estimate the response percentage to the questionnaire because the email recipients had been able to send e-mail forward to many people. The estimated response percentage of the questionnaire is 50 % because 8 people responded to the questionnaire research.

3.2 Fennoscandian shield

The metal production in Europe is about 3 % of the whole world metal production but Europe uses 20-30 % of world metal production yearly. The whole economy of Europe depends heavily on raw materials. The European Union wants to increase that ratio between the production and consumption of metals to become more self sufficient and that is basically the mineral politics of European Union. The mineral resources of Fennoscandian shield have significant importance for Europe. One aspects which is the cause of this is the fact that almost half of new exploration and mining projects for metal in Europe takes place in Sweden and Finland. (Eilu 2011, 14.) European Union published the raw materials initiative in 2008. The purpose is to channel financial supports to the mining industry and the efficient utilization of mineral resources. (Berg-Andesson, Hernesniemi, Rantala & Suni 2011, 34.)

Fennoscandian shield is a geological term for area which comprises Norway, Finland, Sweden and northwestern Russia. A map of Fennoscandian shield is shown in figure two. (Eilu 2011, 14-15.) This market research will focus mainly on Finland but also there will be part of mining market opportunities in Sweden, Norway and Greenland. According to Eilu (2011, 21-22), Fennoscandian shield area include the large metal mineral resources of chromium, titanium, iron ore, lithium, nickel and zinc. There is estimated that metal mineral resources of Cr, Li, Nb, Ni, REE, Ta, Ti, and V could potentially cover more than 50 years of the EU demand and resources of iron ore, Co, PGE, and U sufficient for 10–30 years for European union. The most of the Fennoscandian metal minerals needs hard rock mining and enrichment technologies. (Eilu 2011, 20-21.)



Figure 2. Fennoscandian shield geological areas. (Eilu 2011, 15.)

3.3 Finnish mining industry

Finnish mining industry was re-born after a year 2000 (Uusisuo 2013, 3). At the present there are 12 metal ore mines and about 29 industrial minerals mines in operation in Finland (Pokki 2013). The estimated turnover of Finnish mining industry was 1.48 billion euro in the year in 2011. The total turnover of metallic mineral mines was around 963 million euro. There are 2 700 employers directly in the mines and the subcontractors of mines employ about 1 900 people. Finnish mining industry is growing all the time. Investments of projects that are planned are more than four billion euro in

future. It has been estimated that the industry will need about 5 600 new workers and professionals by 2022. Most of these projects are located in northern and eastern Finland. (Uusisuo 2013, 3.)

The Finnish Tilastokeskus (Statistic Center) has estimated that the total impact of mining industry is about 0.5 % of the gross domestic product in 2011. It is quite low percent because the impact of the whole other Finnish industry has estimated to be 17.2 % . There was no information given by the impact on GDP in 2011 and there was not anything statistic in the year 2012. (Suomen virallinen tilasto 2013.)

The annual total number of mining was 59 million tons in 2009 in Finland. The ETLA has estimated that the annual total number of mining will triple during the next years. It would be 155 million in 2016 in Finland. The annual number of metal ore mining will rise from 24 million tons to 68 million tons. (Berg-Andesson et al. 2011, 13.)

3.3.1 Metal ore mines in Finland

In September in 2012 there were 12 metal ore mines in operation in Finland (Uusisuo 2013, 20). Those mines and some other information on companies is shown presented in table two. There were five gold mineral mines and other mines production based on chrome, copper, nickel, zinc, sulphur, silver, cobalt and platinum group metals (pGM) (Uusisuo 2013, 20). Finnish metal ore mines are described in more detail after table two. There is general information about metal mining companies and their stakeholders, total mine tons annually, equipment, technologies and investments.

Table 2. Finnish metallic mineral mines in 2012. (Uusisuo 2013, 21.)

Mine, municipality	Name of the company	Name of the parent company	Key valuable minerals
Kittilä (Suurikuusikko), Kittilä	Agnico-Eagle Finland Oy	Agnico-Eagle Mining Ltd. (CA)	Gold
Hitura, Nivala	Belvedere Mining Oy	Belvedere Resources Ltd. (CA)	nickel, copper, cobalt, platinum, palladium
Pahtavaara, Sodankylä	Lapland Goldminers Oy	Lapland Goldminers AB (publ) (SE)	gold
Kemi, Keminmaa	Outokumpu Chrome Oy	Outokumpu Oyj	Chromium
Jokisivu, Huitinen (concentrating plant in Sastamala)	Dragon Mining Oy	Dragon Mining Ltd. (AU)	Gold
Orivesi, Orivesi (concentrating plant in Sastamala)	Dragon Mining Oy	Dragon Mining Ltd. (AU)	Gold
Pyhäsalmi, Pyhäjärvi	Pyhäsalmi Mine Oy	Inmet Mining Corporation (CA)	copper, zinc, sulphur, silver, gold
Talvivaara, Sotkamo	Talvivaara Sotkamo Oy	Talvivaara Mining Company Plc	nickel, zinc, uranium
Pampalo, Ilomantsi	Endomines Oy	Endomines AB (publ) (SE)	Gold
Laiva (Laivakangas), Raahel	Nordic Mines Oy	Nordic Mines AB (SE)	Gold
Kylylahti, Polvijärvi (concentrating plant in Kaavi)	Kylylahti Copper Oy	Altona Mining Ltd. (AU)	copper, cobalt, nickel, zinc, gold
Kevitsa, Sodankylä	Kevitsa Mining Oy	First Quantum Minerals Ltd. (CA, UK)	copper, nickel, PGM, gold

Agnico-Eagle Mining Ltd is an international company from Canada. The revenue of the company was about 1.48 billion euro in 2012. (Agnico-Eagle 2013c.) It has a mine and an exploration office in Kittilä. In the mine of Kittilä the main mining mineral is metallic gold. The life span of Kittilä mine is estimated to be extend to 2044. (Agnico-Eagle 2011.) It has other mining and exploration activities in Canada, USA and Mexico (Agnico-Eagle 2013a). Kittilä mine is now underground mine only. The mill of Kittilä processed ore an average of 2.979 tons per day in 2012 which translated to 1.09 million tons per year. (Agnico-Eagle 2013b.) In total 3.4 million tons rock was mined in 2012 in Kittilä (Pokki 2013).

The interviewee works in the mine and factory maintenance. He has heard about the products of Parker Hannifin and they have those products in mining machines of Sandvik and Normet. Agnico-Eagle has no mining contractors in the underground mine at the present. The mining equipment of Agnico-Eagle Kittilä consists of mining machines from Scania, Sandvik and Normet. The interviewee said that that they have a workshop for mining machinery maintenance in the underground mine. The company is considering to organize a competitive tender for the hydraulic components. The

company is familiar with shelf-carrier agreements and it has agreements about some spare parts of mining machines but it does not have agreements about hydraulic components yet. They have been satisfied for self-carrier agreements. The interviewee said that the company would prefer to buy spare parts as original parts. The interviewee told that they have had a hydraulic hose production container but today they have a company's own hose assembly place in the underground mine. The interviewee said that the EU laws and standards limit the procurement for the underground mine and especially purchasing from the USA. The interviewee told for underground mines that the laws and standards are stricter in Europe than in North America. For instance diesel engine exhaust emissions are more limited in Europe. The company has an investment project to expand a production plant at the present and it has plans to build a lift shaft. The company has invested a lot of energy saving and heat saving systems.

Canadian company **Belvedere Resources Ltd** has a mine in Nivala in Finland. Company is listed on stock market Ventures in Toronto. In the mine it operates as Belvedere Mining Oy which is subsidiary of Belvedere Resources Ltd. The main mining mineral is metallic nickel from the underground mine which is called Hitura. (Belvedere Resources 2013a.) Strategy of Belvedere Resources Ltd is to focus on developing and exploring nickel and gold mineral projects in Finland. The revenue of Belvedere Resources Ltd was 27.86 million euro in 2012. Life span of Hitura mine is estimated to extended until 2016. 85 % of mineral resources have been processed by now. (Belvedere Resources 2013b.) The mine of Hitura milled and mined total 659 000 tons nickel ore in 2012 (Belvedere Resources 2013b; Pokki 2013). They did not mine waste rock in Hitura (Pokki 2013). The mine employs many subcontractors. Maansiirto Jarkko Ralli Oy is responsible for ore and waste rock transporting and storing. Pohjolan Kallityö Oy does ore and waste rock quarry and tunnel support construction. H.Suikunen Oy is responsible for concrete production and transportation, product packaging and transport to port. (Belvedere Resources 2013a.) Belvedere Resources Ltd has expansions plans in Finland and it has invested in gold exploration projects in Finland. Kopsa and Antikanperä gold deposits are located near the mining field of Hitura and the company has designed to transport a gold mineral for enrichment to Hitura. Mine of Kopsa is expected to start production in 2014 or 2015. Belvedere Resources Ltd has some the gold mineral exploration projects in Kuusamo and Rantasalmi. (Belvedere Resources 2013b.)

One person answered a questionnaire from Hitura mine. That questionnaire was designed for mining companies. The respondent works in management of the company. At first the respondent told that Hitura is only mine of Beldevere Resources Ltd and a production is closed at the present. He mentioned that he has heard about the products of Parker Hannifin but they did not use those products. Normally they do maintenance works by employees of the company but occasionally they also use contactors. The company has eight Tamrock and six Normet mining machines. It has a store of critical spare parts of mining machines. They buy the hoses and connectors for mining machines from a local supplier which is Ahhsel. The company has not organized a competitive tender for the spare parts. The respondent told that they satisfied for the spare parts store system of the company and they are not planning to change that. At the ended of the questionnaire the respondent hoped that electronic systems of mining machines could be simpler.

Lapland Goldminers AB is Swedish mining company which has a gold mineral mine in Pahtavaara in Finnish Lapland. There it operates as their subsidiary Lapland Goldminers Oy. (Lapland Goldminers 2013b.) The annual sales of Lapland Goldminers AB was 24.5 million euro in 2012 (Lapland Goldminers 2013c). Lapland Goldminers AB has gold mineral deposits in Fäböliden and in the gold mine. Fäböliden is located near the headquarters of the company which is in Lycksele in Sweden. Fäböliden gold deposit has an environmental permit and the project is working now to define a feasibility study. When the mine of Fäböliden will materialise it will mine five million tons ore in a year. (Lapland Goldminers 2013a.) Pahtavaara mine is near Sodankylä. It mined 521 000 tons gold ore in 2012. (Lapland Goldminers 2013c.) Totally it mined 710 000 tons rock in 2012 (Pokki 2013). Gold ore resources are likely to reach a three-year production in Pahtavaara mine. Pahtavaara is an underground mine. (Lapland Goldminers 2013c.)

Outokumpu Oyj is an international mining and steel company. Their subsidiary Outokumpu Chrome Oy is operating in Kemi in the only mine of Outokumpu Oyj. The headquarters of Outokumpu Oyj is located in Espoo. (Outokumpu 2013a.) The revenue of Outokumpu Oyj was 4 538 million euro in 2012 (Outokumpu 2013b). Chrome mineral is the main ore that Outokumpu Chrome Oy mines in Kemi. The mine of Kemi is underground. (Outokumpu 2013c.) 1.25 million tons ore was mined in 2012 and totally 1.9 million tons rock was mined in 2012 in Kemi (Pokki 2013).

Two people from mine of Kemi were interviewed. Both those interviewees were interviewed at the same time so the situation was closer a focus group interview than an original interview. Both interviewees work in maintenance of the underground mine. Interviewees had heard before about the products of Parker Hannifin. They mentioned that they use fluid connectors, hydraulic components and filtrations of Parker Hannifin in their mining machines. Outokumpu has 17 mining machines from Atlas Copco, Sandvik and Normet in Kemi. Interviewees told that Outokumpu does all other mining works themselves in underground mine but Tapojärvi Oy is responsible for ore loading and hauling works and Forcit Oy is responsible for mine blasting works. They told that all companies serviced their own mining machines. There is no integrated maintenance between companies in the underground mine. Outokumpu has maintenance for mining machines. Interviewees told that Outokumpu is interested in buying spare parts for mining machines also from other sources than only from an original equipment manufacturer. Outokumpu Oyj has organized a competitive tender for spare parts. Those agreements apply to the entire group. In the mine of Kemi there is a workshop for hose assembly and they are satisfied with that. Ares supplies hydraulic hoses directly to a store of Outokumpu at the present. They said that laws and standards do not affect underground mine the operations of procurement because usually it is the suppliers responsibility in Finland. Interviewees said that the ore mine level will increase 2.7 million tons in the next year. Interviewees told that their company is very interested in more economical, electric- and hybrid powered and automatic mining machines. They said that energy and environment will be big words in mining machines in future. Monitoring the condition of the hydraulic system is not seen as necessary in mining machines.

Dragon Mining Ltd is an international mining and exploration company from Australia. Company revenue was 79 million dollars in 2011. (Dragon Mining 2013b.) It has two underground gold mineral mines Orivesi and Jokisivu in Finland. Mined ore is transported by truck to a production centre of Vammala from the mines of Orivesi and Jokisivu. Also there is an open pit gold mineral mine and a process plant in Svartliden in Sweden. (Dragon Mining 2013a.) Svartliden process plant processed gold ore about 333 000 tons in 2012 (Dragon Mining 2013b). Dragon mining Ltd has exploration projects in Ritakallio and Kaapelinkulma. Those are located near Vammala. Other exploration projects are in the northern Bothnia in Kuusamo and in the northern Lapland in Sukseton, Hanhimaa and Tepasto. (Dragon Mining 2013a.) Vammala

production plant processed ore about 290 000 tons in 2012 (Dragon Mining 2012). In total 0.4 million tons rock was mined in Jokisivu and 0.33 million tons in Orivesi (Pokki 2013). Jokisivu and Orivesi ore resources are estimated for approximately eight years of gold production in Vammala. Dragon Mining Ltd estimated to begin production in 2018 in Kuusamo. At Hanhima gold project the company has made agreement with Agnico-Eagle Ltd which can invest in the next three years five million to Hanhima exploration. (Dragon Mining 2013b.)

Talvivaara Mining Company Plc is Finnish mining company. Company has an open pit mine in Sotkamo and operates there as Talvivaara Sotkamo Oy. (Talvivaara 2013b.) The revenue of Talvivaara Mining Company Plc was 142.9 million euro in 2012 (Talvivaara 2013c). The mineral resources of Talvivaara consist mainly of nickel, copper, cobalt and zinc (Talvivaara 2013a). Talvivaara mined ore 8.7 million tons and waste rock 5.5 million tons in 2012. In the year in 2012 there were many problems in Talvivaara and the production was down for long periods of time. In total Talvivaara mined rock 27.3 million tons in 2011 and this figure is more representative of production level. The metallic ore resources are estimated to be about 20 to 53 million tons and it is sufficient for several decades. Talvivaara invested in a uranium recovery plant. That plant will be ready for production mid 2013. They are still waiting for an environmental permit and a chemical authority approval for uranium production. Also, Talvivaara is planning to increase its nickel production process capacity from about 15 000 tons to 100 000 tons in a year. It has not yet made investment decision of the capacity increase. (Talvivaara 2013c.) The latest news of Talvivaara is that they negotiated with employee lay-off in July 2013 (Yle 2013). There have been many problems in Talvivaara and those have had a financial effect.

Endomines AB is a Swedish mining and exploration company which consists of Endomines Oy and Kalvinit Oy. Endomines Oy is focused on gold deposits and projects and Kalvinit Oy is focused on ilmenite deposits and projects. All of Endomines AB mineral deposits are located in Finland. (Endomines 2013a.) Strategy of Endomines is focused on gold deposits and they would sell their ilmenite deposits in the near future. Endomines AB is planning a listing on the Helsinki Stock Exchange. (Endomines 2013b.) The revenue of Endomines AB was 27.5 million euro in 2012 (Endomines 2013c). In total the level of rock mining was 380 000 tons in 2012 in Pampalo (Pokki 2013). Endomines Oy mined gold ore 250 000 tons in 2012 from the underground mine

of Pampalo which is in Ilomantsi. Endomines Oy has planned to establish satellite mines near a Pampalo production plant. It has an exploration project in Karelia in Rämepuro, Hosko, Muurisuo and Korvilansuo and in Lapland in Kivimaa and Porkonen. All of Karelia projects are located in 25 kilometer from the Pahtavaara production plant. The company has estimated to begin mining production in 2014 in Rämepuro and after that the company will open mine in Hosko. Gold production will continue several decades in Ilomantsi. (Endomines 2013b.)

Nordic Mines AB is a Swedish mining and exploration company. The revenue of the company was 28.9 million euro in 2012. Nordic Mines AB has mine in Raahe in Finland. (Nordic Mines 2013a.) Mine is an open pit gold mine and it is called Laiva. Mined rock tons were 5.1 million tons and milled ore tons were 1.03 million tons in 2012 in Laiva. (Pokki 2013.) Ore resources will last at least 15 year production. Nordic Mines AB has four gold mineral exploration projects and one silver mineral exploration project which called Vassbo. It is exploring in Laiva and Oltava which are located near a production plant of Raahe. Also, it has exploration project in Tormua which is in the northern Kainuu in Finland. Other two explorations fields of Nordic Mines AB are in Sweden in Fjälltuna in Västerbotten and in Vassbo in the northern Dalarna. (Nordic Mines 2013b.)

Altona Mining Ltd is a copper mining and exploration company from Australia. It has a mine in Kylylahti and a production plant in Luikonlahti in Outokumpu area, Finland. Altona Mining Ltd began mining in Kylylahti underground mine in 2012. (Altona Mining 2013a.) It has estimated to mine ore 550 000 tons annually (Altona Mining 2013b). Altona Mining Ltd mined rock 726 600 tons in 2012 in Kylylahti (Pokki 2013). It has been estimated that there is mineral resources for 8 year production in the mine of Kylylahti (Altona Mining 2013d). Altona Mining Ltd has two closed mines and four new resources in 30 kilometers from Luikonlahti mill which regional resources include nine million tons copper-gold-zinc ore. Also, Altona Mining Ltd has a nickel ore exploration project in Kuhmo, Finland and a copper-gold ore exploration project Roseby in north-west Queensland, Australia. (Altona Mining 2013a.) The Roseby project is a very large open pit mine project. It is planned to begin production in mid 2014. The production plant of Roseby is planned for 6 million tons ore flow annually. (Altona Mining 2013c.)

One person from Kylylahti mine of Altona Mining Oy answered to a questionnaire which was designed for mining companies. The respondent works in maintenance of mining machines. He told that he has heard about the products of Parker Hannifin but they do not use those products at the present. The company has outsourced hauling and loading operations of mine but they do themselves all other mining works. Their mining equipment comes from Sandvik and Normet. The company has maintenance for mining machines. The spare parts for mining machines come from a local supplier and from an original equipment manufacturer. They buy hydraulic hoses from Dunlop Hiflex. The company has a store of critical spare parts of mining machines. It has not organized a competitive tender for spare parts. The respondent estimated that a site container, maintenance service car and spare part store of the company are all efficient and reliable delivery models. He hoped that self-diagnostic systems would increase in the mining machine in the future.

First Quantum Minerals Ltd is an international mining and exploration company which has seven mines and five developing projects around the world. First Quantum Minerals has focus on metal mineral mining and production. It has an open pit nickel-copper-PGM mine Kevitsa in Sodankylä, Finland and the underground copper-zinc ore mine Pyhäsalmi in Pyhäjärvi, Finland. Other mining activities of the company are located in Zambia, Mauritania, Spain, Australia and Turkey. (First Quantum Minerals 2013a.) The revenue of First Quantum Mineral Ltd was about 2 283 million euro in 2012 (First Quantum Minerals 2012). Company mined ore about 7.6 million tons in 2012 in Kevitsa. The production reached planned production level only at the end of the year 2012 so the expected ore production level would be much more in 2013. The life span of the mine has been estimated to be about 29 years. (First Quantum Minerals 2013b.) First Quantum Minerals bought the Inmet Corporation in 2013. The mine of Pyhäsalmi was part of the Inmet. The mine processed ore 1.4 million in 2012. It is estimated that the production will continue until 2019 in Pyhäsalmi. (First Quantum Minerals 2013c.)

One person was interviewed from mine of Pyhäsalmi. The interviewee works in maintenance of mining machines. He has heard about the products of Parker Hannifin but he did not know how much they use spare parts of Parker Hannifin in mining machines. It has an open pit waste rock quarry where a subcontractor operates at the present named Maaselän Konetyö Oy. The interviewee told that they have mining

machines mostly from Normet and Sandvik. Service employees of Pyhäsalmi do all maintenance work for mining machines at an underground maintenance work station. Normally they buy spare parts for mining machines from original equipment manufacturers. It has a hydraulic hose assembly place in the underground mine and they buy materials for assembly from a local store. The interviewee told that it is more reliable to buy filtrations and other special parts from OEMs than from a local market. The company is satisfied for business with OEMs. The interviewee mentioned that they have a spare parts store in the underground mine without any system filling agreements and they are very satisfied for that. The interviewee said that laws and standards do not affect supplying any more special for an underground mine than for an open pit mine. The mining company has organized a competitive tender for hydraulic components for mining machines but the interviewees said that they have not made agreements of all supply of spare parts for mining machines. The mining company is continuously investing in new mining equipment. The interviewee said that they are not interested in electric-powered ore hauling and loading machines as those systems are not sufficiently developed. The electric power should be produced without an external source for hauling and loading machines as those machines are used in a large area of the mine and the work sites move fast. It would be a great help for mining machines maintenance if the machine itself would recognize and localize faults and especially the faults of electronic and hydraulic systems. The troubleshooting takes a lot of maintenance time. Other problem that the interviewee had recognized was that there could be a sensor for outside air quality monitoring in the mining machines because drivers have just personal sensors at the present. The interviewee estimated that the significance of mine safety will continue to increase in the future.

3.3.2 Industrial mineral mines in Finland

In the year 2011 there were operations in 31 industrial mineral mines and quarries in Finland. Not all industrial mineral mines have active production every year. Industrial mineral companies mainly mining carbonate rocks, apatite, talk, limestone and industrial stone in Finland. (Uusisuo 2013, 21.) Finnish industrial mines in 2011 are shown in table three. There is more specific information given by industrial mining companies later in this chapter.

Table 3. Finnish industrial mineral mines in 2011. (Uusisuo 2013, 22.)

Name of the company	Name of the parent company	Key valuable minerals	Municipality (underground/open-pit mine)
Juuan Dolomiittikalkki Oy		dolomite, limestone	Paltamo (Reetinniemi), Juuka (Matara)
Nordkalk Oy Ab	Rettig Group	limestone, dolomite, wollastonite	Huittinen (Matkusjoki, Putkinotko), Sipoo, Kerimäki (Ruokojärvi), Lappeenranta (Ihalainen), Vimpeli (Ryytimaa, Vesterbacka), Lohja (Tytyri), Parainen (Limberg-Skräbböle), Kesälahti (Ahola), Raasepori (Mustio)
SMA Mineral Oy	SMA Mineral AB (SE)	dolomite, quartz	Tornio (Kalkkima, Rantamaa, Ristimaa), Pieksämäki (Ankele)
Salon Mineraali Oy	Omya Oy	Limestone	Salo (Hyypiänmäki)
Sibelco Nordic Oy Ab	Sibelco Group	feldspar, quartz	Kemiönsaari (Kyrkoberget, feldspar), Nilsjä/Siilinjärvi (Kinahmi)
Yara Suomi Oy	Yara International ASA (NO)	Apatite	Siilinjärvi
Mondo Minerals B.V. Branch Finland	Mondo Minerals B.V. (NL)	tal, nickel	Sotkamo (Uutela, Punasuo), Polvijärvi (Pehmytkivi, Horsmanaho)
Paroc Oy Ab	Paroc Group Holding group	industrial stones	Lapinlahti (Joutsenenlampi), Mäntyharju (Lehlampi), Parainen (Ybbernas), Salo (Sallittu), Savitaipale (Vanhasuo)
Rudus Oy		industrial stones	Lemi (Mustamäki)

Nordkalk Oy Ab is a Finnish industrial mineral mining and production company which is member of Rettig Group. Basically, Nordkalk Oy AB mines and produces limestone products. The revenue of Nordkalk Oy Ab was 351 million euro in 2012. Nordkalk is operating in nine countries and it has mines and quarries in five countries. (Nordkalk 2013a.) Nordkalk has a large investment project in Sweden. It will open a new limestone quarry in Bunge in Gotland, Sweden and will begin a production in Bunge in 2013 and it has estimated that the quarrying will continue at least 25 years. Nordkalk will invest more than 60 million euro to Bunge. (Rettig group 2013a.) Nordkalk quarries limestone more than 10 million tons yearly (Rettig group 2013b). Nordkalk have seven mines in Finland in Parainen, Lappeenranta, Louhi, Sipoo, Tytyri (Lohja), Vimpeli and Siikainen. Of those Louhi, Sipoo and Tytyri are underground mines. Company has large activities in open pit quarries in Parainen and Lappeenranta. Parainen mines 2.4 million tons rock and Lappeenranta mines 2.1 million tons rock yearly. (Nordkalk 2013b.) Nordkalk mined 5.3 million tons rock in 2012 in Finland. The third biggest mine of Nordkalk is Tytyri where 286 000 tons rock was mined in 2012. (Pokki 2013.)

SMA mineral AB is Swedish mining and mineral company which have four industrial mineral mines in Finland. In the Finnish mines it operates as SMA Mineral Oy. It

produces limestone based products. (SMA mineral 2013.) SMA minerals mined 121 000 tons rock in Finland in 2012. The main industrial mineral production is located in Pieksamäki and Tornio. (Pokki 2013.)

Yara International ASA is a Norwegian large mining and mineral company. Company has operations in more than 50 countries. The revenue of the company was 11.2 billion euro in 2012. (Yara International 2013.) Yara International ASA has subsidiary in Finland which called Yara Suomi Oy. The Finnish company has production plants in Kokkola, Uusikaupunki, Harjavalta and Siilinjärvi. Mine of Yara is located in Siilinjärvi which is an open pit mine. (Yara Suomi 2013a.) Rock was mined 21.4 million tons in Siilinjärvi in 2012 (Pokki 2013).

One person from Siilinjärvi mine of Yara responded to a questionnaire which was designed for mining companies. The respondent works with maintenance management of a production plant. He told that he has heard about the products of Parker Hannifin but did not use those products in the production plant of Siilinjärvi. The respondent told that there are 20 employees working in the maintenance of the production plant and they uses subcontractors in maintenance works continuously. The production plant of Siilinjärvi buys spare parts from a local supplier. It has not organized a competitive tender for spare parts. The respondent told his opinion about delivery models. He thought that a site container, a maintenance service car, a store self-carrier contract and a spare part store of the company are all developed delivery models. The respondent told that Yara Siilinjärvi will invest in the new crushers and renovation of mills in near the future.

Mondo Minerals B.V is an international mining and mineral company which is the second largest talc producer in the world. It has two production plants and mines in Vuonos and Sotkamo, Finland and one production plant in Katwijk, Netherlands. (Mondo Minerals 2013.) Mondo Minerals has begun production in Punasuo mine, Sotkamo in 2010. It has evaluated that the production will continue decades in Sotkamo. Punasuo is an open pit mine. (Yle 2010.) Mondo Minerals B.V mined rock 3.6 million tons in Finland in 2012. It mined rock 1.7 million tons in Sotkamo an 1.9 million tons in Polvijärvi in 2012. (Pokki 2013.)

An interviewed person from Mondo Minerals B.V works in management in Sotkamo. The interviewee told that Mondo Minerals B.V has operated a long time in Finland. A production process of Mondo Minerals consists of three main steps. Those are an open pit mine where it operates via E. Hartikainen Oy, enrichment plant which based on flotation and final product plant which produce talk products for customers. All those three plants are located in the same area in Sotkamo. The Interviewee had heard about Parker Hannifin but he did not know are they using any products of Parker Hannifin in Mondo Minerals Sotkamo. The interviewee mentioned that Mondo Minerals has one big competitive tender where they are selecting a mining contractor for the mine of Sotkamo. The interviewee said that there are six contractors who could operate in large mines in Finland those are E. Hartikainen Oy, Destia, Lemminkäinen, YIT, Tallqvist and Tapojärvi. The interviewee did not have opinion on what spare parts delivery models are expected to work. He told that there are certain requirements for mining machines in the Finnish mining market. Those requirements depend on the Finnish mining law and blasting law. Mondo minerals do not have large investments in the near future.

Paroc Group Holding Group is an international stone wool production company. The revenue of the company was 405 million euro in 2011. It has operations in 13 countries and the headquarters is located in Finland. (Paroc 2013.) The company has operations on three mines in Finland in 2012. It mined rock 154 200 tons in Lapinlahti, 74 300 tons in Mäntyharju and 40 050 tons in Savitaipale in 2012. In total it mined rock 268 500 tons in Finland in 2012. (Pokki 2013.)

Sibelco Group has production in 228 operation sites in 41 countries. Basically, Sibelco Group is an international mineral and mining company which produces non-metallic minerals. (Sibelco Group 2013a.) The revenue of the company was over 2 billion euro in 2010 (Sibelco Group 2013b). The company has production in two mines in Finland in Kemiö and Siilinjärvi. It mined rock 73 000 tons in Kemiö and 86 000 tons in Siilinjärvi in 2012. (Pokki 2013.)

Juuan Dolomiittikalkki Oy is Finnish limestone and construction rock producer. Company has two production sites which are in Juuka and Paltamo. (Juuan Dolomiittikalkki 2013.) The company mined rock 9 050 tons in Juuka and 44 400 tons in Paltamo in 2012 (Pokki 2013).

Omya AG is a large global company which produces industrial minerals. It has activities in more than 50 countries. (Omya 2013b.) Omya has four production sites in Kemi, Förby, Imatra and Lappeenranta in Finland. The company produces marble and limestone in Finland. (Omya 2013a.)

Rudus Oy has operations in Finland, Baltia and Russia. The revenue of Rudus was 338 million euro in 2012. Rudus Oy is part of a group CRH plc which is from Ireland. (Rudus 2013a.) Rudus Oy provides products and services from several areas are rock material products, ready-mixed concrete products, crushing services, concrete products and recycling services in Finland (Rudus 2013b).

3.3.3 Mining projects and investments in Finland

The life cycle of a mine is usually considered to have three stages: exploration and development project; production and the closure of mine and production operations. Normally from the ore deposit finding to establishment of a mine takes about 7-10 years. The mine establishment requires assessments and permits and that process takes about 2-3 years. A construction process of mines and production plants takes 1-2 years. Process adjustments and production ramp-up could take time from couple months to several years. (Uusisuo 2013.)

There are 10-15 significant mine and production plant projects in Finland at the present. Those are shown in table four. Mining companies have reported that the investments in these projects will be more than 4 billion euro. The constructions of mines and production plants have estimated to take place in 2013-2017. Some of these projects are already delayed because the negative attitudes toward mining are increasing in Finland. That has effected on environmental permit processes which require a more detailed researches of environmental impacts. Also, there have been problem with financing of some projects (Uusisuo 2013.)

Mining projects were a one part of research. A questionnaire was sent for five mining projects. Two people replied to a questionnaire. A first respondent works in the mining project of Gold Fields Arctic Platinum Oy and he told that the project works on pre-feasibility study and they do not have interest in participating in the market research at

the point where the project is. There was some information of the company in public sources. The mining project of Gold Fields Arctic Platinum Oy is part Gold Fields Ltd group. They are planning mine to Suhanko, Ranua. The ore of Suhanko includes Pd, Pt, Cu and Ni metals. The project is planned to start the acquisition of mining equipment in 2014 and mining would begin in 2016. They will build a production plant next to mine in Ranua. (Gold Fields Arctic Platinum 2013.)

The second respondent for the questionnaire works in the mining project of Keliber which has designed a lithium mineral mine in Länttä, Kaustinen. The respondent works in management of the company. He told that he has not heard of the products of Parker Hannifin before the questionnaire. The company has planned to use contactor in ore quarrying, loading and hauling operations. Also, it has planned to outsource some of maintenance works. The respondent could not answer for questions about mining machines because they are not yet an acquisition phase of mining machines. The company has not made any contacts with the manufacturers of mining machines yet. He told that company will focus on an ore exploration and a detailed production plan the following 1-1.5 years.

Table 4. Significant mining projects in 2012 in Finland. (Uusisuo 2013, 23.)

Mine/project, municipality, company	Investments, EUR million	Manpower requirement, employees	Notes
Expansion of the Kemi chromium mine and ferrochrome works, Outokumpu Chrome Oy	420	120	Construction 2010–2012. Commissioning of the extension at the beginning of 2013.
Hannukainen iron mine, Kolari, Northland Mines Oy/Northland Resources S.A. (LU)	300	360	Feasibility study is expected in late 2012.
Sokli apatite mine, Savukoski, Yara Suomi Oy/Yara International ASA (NO)	700	200	Implementing the drilling programme and supplementing the evaluation of the 'Finland' alternative in 2012. Appeals relating to the regional land use plan concerning Sokli were rejected by the
Expansion of the Kevitsa mine (nickel, copper), Sodankylä, Kevitsa Mining Oy/First Quantum Minerals Ltd. (CA, UK)	?	?	An environmental and water permit is pending for the expansion.
Mustavaara mine and smelter (iron, vanadium), Taivalkoski/Posio, Mustavaaran Kaivos Oy	400	250	A feasibility study for the mine, concentrating plant, and smelter are in progress. Smelter location alternatives to be studied for the EIA are Mustavaara, Oulu, Raahe, and Tornio. Decision on construction possibly in 2014. Planned construction in 2014–2016.
Sakatti project (copper, nickel, PGM, gold), Sodankylä, AA Sakatti Mining Oy/Anglo American plc (UK)	?	?	Exploration continues. Exploration employs about 150–200 people.
Rompas (gold), Ylitornio/Rovaniemi, Mawson Resources Ltd. (CA)	?	?	Claim decision in November 2011. Appeal process pending. Drilling campaign has been agreed on with private landowners.
Kylylahti mine and the expansion of the Luikonlahti concentrating plant (copper, cobalt, nickel, zinc), Kylylahti Copper Oy/Altona Mining Ltd. (AU)	6	?	Expansion of the concentrating plant as well as development of the satellite mines and processing their ore in Luikonlahti.
Taivaljärvi silver mine, Sotkamo, Sotkamo Silver AB	30	70–90	Construction is planned to commence in 2012. Planning will begin with a planning requirement decision.
Gold mine, Kuusamo, Dragon Mining Oy/Dragon Mining Ltd. (AU)	?	?	EIA is expected in autumn 2012.
Länttä (lithium), Kaustinen, Keliber Oy/ Nordic Mining ASA (NO)	50–60	60–80	Drilling campaign to determine mineral resources, metallurgical tests and preparation of the feasibility study.
Extraction of uranium as a by-product, Talvivaara Sotkamo Oy	30	?	European Commission approval for extraction was given in January 2012 and a license was granted by the Finnish Government in February 2012. Environmental permit is required.
Talvivaara's expansion projects 50,000/100,000 t Ni (Operation Overlord), Talvivaara Sotkamo Oy	500–1,000	600	Application for the extension of the mining concession area in 2011. EIA commenced in 2011. Aiming to submit an environmental permit application in 2012. Investments in stages over 5–6 years at the end of the decade.

3.3.4 Finnish mining industry stakeholders

Tapojärvi Oy provides a variety of services for mines. At the moment it operates in four mine companies in Finland. Those are Outokumpu Oyj, Agnico-Eagle Ltd, Lapland Goldminers AB and Altona Mining Ltd. Tapojärvi are responsible for ore loading and hauling, filling of quarries and old tunnels, equipping and underground road maintenance in mine of Kemi. They are also responsible for roughly the same activities in the mines of Kittilä, Kylylahti and Pahtavaara. (Tapojärvi 2013a.) All those mines are underground. Tapojärvi has a lot of mining machines and equipment. A list of their mining equipment is available on a web page of the company. It has mining machines from Sandvik, Caterpillar, Mercedes, Scania, Grandall, Volvo and Doosan. The company is specialized to serve underground mines. (Tapojärvi 2013b.)

Destia Oy is a Finnish infrastructure building and construction service company which builds, maintains and designs traffic routes and industrial environments and also living environments. It also has expertise in the construction of the underground such as traffic tunnels and parking lots. The revenue of Destia group was over 500 million euro in 2012. Destia group has about 1600 employees. (Destia 2013.)

A representative of Destia Kalusto Oy responded to a questionnaire which was designed for a contractor. The respondent works with spare part purchasing of machines and equipment. He told that Destia use the hydraulic connectors of Parker Hannifin in their mining machines. Destia has outsourced the maintenance of mining machines. It has ten mining drill machines and two mining machines from Normet. The respondent told that the mining machines maintenance is combined between parent company and contractors in Talvivaara, Sotkamo. Destia has ensured the availability of spare parts by the warehouse of supplier. They buy hydraulic components and hoses from Dunlop Hiflex and Specma Hydraulics. Spare parts for the mining machines of Destia come from the maintenance contractors and from the original equipment manufacturers. The respondent told that the spare parts store of the company is difficult to operate for the company and he is not satisfied for the idea of the company's own store of spare parts. The respondent told that they are constantly investing in new mining equipment.

Ab Tallqvist Oy group consists of three companies. Those companies are Ab Tallqvist Infra Oy, Ab Tallqvist Rental Oy and Ab Tallqvist Energy Oy. The revenue of Ab

Tallqvist Oy has been annually about 15-22.5 million euro in recent years. That Ab Tallqvist Infra Oy is a subcontractor of mining companies in Finland. Tallqvist operate in two mines in Talvivaara, Sotkamo and in Laiva, Raahe in Finland. It has mining equipment for large open pit mines. Also Tallqvist has maintenance services for mining machines and it rents mining machines. Their mining machine equipment consists of Doosan, Komatsu, Caterpillar, Daewoo, Volvo, Sandvik, Atlas Copco and Scania machines. (Tallqvist 2013a.)

E.Hartikainen Oy is Finnish a civil engineering and construction company. They provide a variety services for mines in Finland. E.Hartikainen Oy has more than 300 employees in Finland. (E. Hartikainen Oy 2013b.) They are working currently in five mines and one road construction project. Those mines are Kevitsa (FQM), Siilinjärvi (Yara), Talvivaara, Polvijärvi (Mondo Minerals) and Sotkamo (Mondo Minerals). E. Hartikainen is responsible typically for ore and waste rock hauling and loading in the mines where they operate. Also, it provides mining services and E. Hartikainen Oy perform excavation works of Mondo Minerals in Sotkamo and Polvijärvi. (E. Hartikainen Oy 2013a.) E. Hartikainen Oy has 63 mining trucks, 7 articulated trucks, 49 excavators. Those mining hauling and loading equipment are mostly Caterpillar, Hitachi and Komatsu products. Also, it has many machines for a mining and road construction. (E. Hartikainen Oy 2013c.)

An interviewee of E. Hartikainen Oy is working with the mining operations of the company in Sotkamo. He told that they are responsible for all works in the open pit mine of Mondo Minerals. It has some subcontractors and one of these is Maxam Finland which takes care of mine blasting in Sotkamo. The interviewee has not heard of the products of Parker Hannifin before the interview. He told mine machines that they have in Sotkamo are mostly Caterpillar and Komatsu products. He mentioned that fuel consumption is a very important part of the mining machinery and it affects a lot of machinery selection. The company does not have delivery contract in spare parts straight to store of the company but in the corporation level it has the negotiated agreements of spare parts. The interviewee did not know where they buy hoses for mining machines. Usually, the contractor has a small store of spare parts such as hoses on site where they operate. The interviewee said that they are interested in economical mining machines because the fuel costs are major part of total costs.

Veljekset Toivanen is a Finnish civil engineering contracting and excavation company. The company has offices in Kemi and Oulu. They provide variety services for mining companies. They are responsible for mining works in the mine of SMA Minerals in Tornio. (Toivanen 2013.)

The interviewee told that the company Veljekset Toivanen was established in 1989. Today the company has about 80 employees, 28 excavators, ten wheel loaders, ten truck cars and about ten tractor excavators. The mining machines are products of Komatsu, Volvo, Caterpillar and JCB. The interviewee said that they have work in the mine of SMA minerals in Tornio from 2006 and they are responsible for loading and hauling of the ore. He told that Parker Hannifin products for the hydraulic hoses are familiar to Veljekset Toivanen. He also mentioned that he is not interested in the hose manufacturer, but the most important thing is that the hydraulic hoses are high quality and durable. The company has a store for hoses that often go broke often but special hoses they buy from the local store. The interviewee told that usually if they buy spare parts such as filtrations, hydraulic components for mining machines they will buy original parts from a local store. The interviewee said that the spare part distribution channels do not have so much importance for them but the delivery time and reliability are the most important things. The interviewee said that CE marking is the only limiting factor in the procurement about laws and standards. Mining machinery fuel cost reduction is an important issue for the company. The interviewee said that in the remote mines it would be good if there could be a one operating the contractor who could sell spare parts such as hydraulic hoses for other contractors as in some mines it is a really long way to drive from the mine to a store to buy spare parts. He said that Parker would be worth to take in the sales force some mining contractors who operate in mines because they already are in working relationships with mines.

Lemminkäinen Oyj is a large construction company which provides variety service for construction industry worldwide. Lemmikäinen Oyj has a lot of expertise in mining and it is able to carry out even the most difficult mining projects. Their subsidiary Tolarock Oy provides contracting services to the mines. Tolarock Oy has mining equipment for fully underground mining. (Lemminkäinen 2013a.) The revenue of Lemminkäinen was 2.26 billion euro in 2012 (Lemminkäinen 2013c). The part of infrastructure construction was 24 % of the revenue in 2012. The share of Lemminkäinen Corporation is quoted on NASDAQ OMX Helsinki (Lemmikäinen 2013b.)

The representative of Tolarock responded to a questionnaire of contactors. The respondent works in management of the company. Tolarock provides many services for mining industry. It has the expertise of production mining, tunnel mining, rock reinforcement and many other underground operations. The respondent told that they used the hydraulic hoses of Parker Hannifin. The company has a field maintenance which makes the daily maintenance on site. A higher maintenance is carried out in a workshop of Tolarock. The respondent told that they have operations on the mines of Pahtavaara (Sodankylä), Kittilä, Taivaljärvi (Sotkamo), Kiiruna (Sweden), Svartliden (Sweden) and Louhi (Puruvesi) at the present. The company has ten Sandvik, one Atlas Copco, one Volvo and one Normet mining machines. It has a store of mining machines critical spare parts on the bigger sites. Lemminkäinen group has organized a competitive tender for spare parts suppliers. The respondent estimated that site containers and the company's own spare part stores are efficient and reliable delivery methods. She has reservations about the idea of service car and self-carrier agreements. The respondent called for more competition on the market of mining drill machines maintenance and production. She told that some equipment and spare parts for mining drill machines are extremely overpriced.

YIT Oyj is a large international construction company which has a lot of variety services and business areas. One business area of YIT Oyj is infrastructure construction. (YIT 2013a.) The revenue of YIT Oyj was 4.706 billion euro in 2012 (YIT 2013c). The share of YIT Oyj is quoted on NASDAQ OMX Helsinki (YIT 2013d). The company provides mining services mines and for the public sector. YIT Oyj has mining machines for fully underground mine construction. (YIT 2013b.)

One person responded to a questionnaire from YIT Rakennus Oy that questionnaire was designed for contactors. The respondent works in a purchasing of mining equipment in YIT Rakennus Oy. The company uses many products of Parker Hannifin. Products such as hoses, connector, valves, filtrations and other hydraulic components. YIT Rakennus Oy has mining machine maintenance on sites and a mining machine maintenance workshop. The respondent told that the company sometimes uses the maintenance of the original equipment manufacturer. It has mining operations at the present in Kylylahti copper mine. YIT Rakennus Oy has seven Atlas Copco, two Sandvik, five Caterpillar, 17 Normet and five Cralius mining machines. It has stores of mining machines critical

spare parts on sites. Usually they buy special parts of original equipment manufacturers and hydraulic hoses from Etra, Polarteknik and Dunlop Hiflex. The respondent estimated that site containers and the own spare part stores of the company are efficient and reliable delivery methods. At the end of the questionnaire the respondent wished that the mining machine service of the original equipment manufacturer should develop to be more effective.

Rotator Oy supplies wheel machinery for Finnish mining and construction industry. They market, sell and maintain equipment. The revenue of the company was 60.5 million euro in 2011. The company has 135 employees in 2011. They supply the equipment of Hitachi and Bell for mining industry. (Rotator 2013.)

One representative of Rotator Oy responded to a questionnaire which was designed for mining contactors. At the present, it has operations on the mines of Talvivaara, Sotkamo and Laivakangas, Raahe. Rotator Oy has a workshop in the mine of Talvivaara and the respondent works there. The company maintains wheel equipment in the workshop of Talvivaara. The respondent told that product of Parker Hannifin is familiar to him but they do not use those products. It has six mining trucks (350 t) and two mining excavators (360 t) in Talvivaara. They maintain those equipment on their workshop. The parent company has its own maintenance for the mining equipment. They buy hydraulic hoses and components from local stores which are Dunlop Hiflex and Etra. The respondents told that they have a store of critical spare parts and they are satisfied for that. They will invest in hand tools in a near future.

3.3.5 Finnish mining market specificity

Fraser Institute published research in February 2013 with a name Survey of Mining Companies. That survey listed mining countries and the survey told that Finland has the most potential policy for mining industry in the world. Also, Finland was ranked very well in other mining country comparisons. (Fraser Institute annual 2013.) The potential policy for mining industry means that there are not extra taxes for mining companies in Finland and Finnish government has been directed supports for education of mining industry (Fraser Institute annual 2013). The mining industry and mining potential in Finland has received a good reputation around the world. Finland is a good country for mining companies.

There are some special aspects of what is good to know when is doing a business with mining companies in Finland. The country is not densely populated and most of the mines are located in sparsely populated areas. Finnish population density is 17.6 people per square kilometer and European population density is 114 people per square kilometer (Kuntaliitto 2013). It means that the supplier would like supply spare parts for Finnish mining industry that have designed for efficient and cost-effective delivery models. There are only a few bigger mines in Finland but usually the Finnish mines small in the world scale. Also the mines are geographically dispersed. There are only a few locality where are more than the one mine. Those are Sodankylä and Sotkamo. The supplier must serve a wide geographical area when doing business with the Finnish mining industry. The mine environment sets some special requirements for spare parts but those are difficult to generalize because specific part of some machine should be looked and what are the requirements for that.

3.4 Other mining industry in the North

The raw materials initiative that European Union has published affects for all countries in the Fennoscandian shield. The mining industry is one fastest growing industry areas in Finland, Sweden and Norway. Governments of these countries support and take part for the mining cluster. Especially, the mining industry has really big effect on political economy in Sweden. In this chapter it is described what there will happen in the northern mining industry in the near future.

3.4.1 Norwegian mining industry

Norwegian mining industry consists of few larger companies which mine iron ore, coal and industrial minerals but most Norwegian mining companies are very small. The mining industry of Norway employed about 6000 employees in 2011. A metal sector of mining industry employed about 1060 employees of that 6000 in 2011. The revenue of mining industry was 1.4 billion euro in 2010. There are several important mining regions in Norway. The biggest of those are Rogaland and the other important regions are Finnmark, Nordland and More og Romsdal. The major products of mining industry that Norway exported in 2011 were iron ore concentrate, coal, ground calcium carbonate and crushed rock. Norwegian mining industry is divided into business sectors

which are Construction raw materials, Industrial minerals, Metal ores, Natural stones and Energy minerals. (Norksbergindustry 2013.)

It has been estimated that when mineral deposit has been found it takes about seven to ten years to the point when the production can begin in Norway. The design and permit process of mine establishing takes that time in Norway. The mining industry is one big industry area which is growing fast in Norway. That is one reason why Government of Norway has designed for a strategy for mineral industry. That was published in July, 2013. Also the government has changed the policy so that support the growth of mining industry. Demand for minerals is increasing in the world all the time and there are a lot of mineral resources and deposits that have not been in production in Norway especially metal mineral resources. The mining industry will expand a lot in Norway. (Norksbergindustry 2013.)

3.4.2 Swedish mining industry

Swedish mining industry has a big part of European mining industry. Investment in the mining industry of Sweden has increased every year since 2006. Those investments in recent years have been about 90 million euro annually. At the present there are about 10 000 employees directly in Swedish mining industry. LKAB is a Swedish state-owned mining company. The company has the biggest European iron ore mine in Kiiruna (Kauppapolitiikka 2012.) Other big mining companies which operate in Sweden are New Boliden, Nordkalk, Dragon Mining, Dannemora Mineral. Also, there are a lot of other mining companies but two big mining equipment manufacturers Sandvik and Atlas Copco have to be mentioned. Those manufacturers have very big market share in underground mining in the world. (Svemin 2012.)

Currently Swedish mining industry is developing and growing very fast. It has been estimated that the production of Swedish mining industry would triple by the year 2025. The mining industry would need 10 000 – 15 000 new direct employees. It is estimated that 7000 of those new direct jobs would be located in northern of Sweden. The growth of Swedish mining industry would increase GDP of Sweden about 3 to 5 percent. (Svemin 2012.)

3.4.3 Greenland mining industry

The mining industry is growing in Greenland. The country is a Danish autonomous region. It is very highly dependent on the support of Denmark. Greenlanders have seen an opportunity in the mining industry. The politics and government of Greenland support the growth of the mining industry. Greenlanders believe that the mining industry would stabilize their economies and they wish that perhaps one day they would be able to become more independent. (Yle 2012.)

The growth of mining industry bases on metal and rare earth element minerals in Greenland. Government of Greenland has approved that the mining companies can bring employees from abroad because there is not sufficient expertise for the needs of the mining industry. (Yle 2012.) There are at least two big mining companies at the present in operation. One company is London Mining which has iron ore mine project in Isua, Greenland. It has designed the factory for 15 million tons annual production. (London Mining 2013.) Another company is Greenland Minerals and Energy Ltd. It has big exploration project in Greenland where they are mapping rare earth element minerals and uranium minerals at the present. (Greenland 2013.)

3.5 Evaluation of research methods and results

The market research data has been planned to be collected with qualitative and quantitative research methods. The questionnaire included optional and structured questions which is usual for quantitative research methods. One thing why the results of the questionnaire can not be considered quantitatively as valid is that the number of responds did not exceed the limit of 200 responds. That is the limit for a data sample of quantitative market research (Hague et al. 2004, 16). The replies to questionnaire have been written very specifically in a report to increase the reliability of the research. The response percent for a mining industry questionnaire was estimated to be 50 % which is very high for an E-based questionnaire. The sample of respondents for a market research is quite small at the end. In total the sample consists of eight responds to the questionnaire of a mining industry, six interviews with the mining industry, three responds to the questionnaire of Parker Hannifin and six interviews with Parker Hannifin.

Even if the number of respondents is small that does not tell the reliability of research. An accurate reporting of research stages and results increase the reliability of the research especially in the qualitative research (Hirsjärvi, Remes & Sajavaara 2006, 216-218). A progress of research has been described carefully and the main results are mentioned. The reliability of research is good for that part which is something which decreases the reliability of research. The interviews and questionnaires should have been more open to questions (Hirsjärvi et al. 2006, 216-218). The qualitative methods did not have this in every question. The respondents were introduced too much in some question and some questions included reply options.

The questionnaire and interviews worked well as research methods. In this kind of market research it is almost impossible to use other methods. These methods of research have provided a lot of new information about the mining market. That information was the main purpose of the market research. The reproductivity of research was very good because questions of the questionnaire and interviews were clear and the responds have been reported specifically in the research. Secondly it is difficult to assess if similar research of the northern Fennoscandian and Greenland mining and technology market can be found. The reproductivity of a research is usually assessed with comparison to other researches (Hirsjärvi et al. 216-218). A lot of mining market information is based

on public sources so that the research is easy to reproduce. The most important thing is that the results and methods served the research very well and those will increase an intelligence of the mining market.

Puheloinen (2005) has done research on mining market of Chile and market of Latin America for electric motors and converters in his Master's thesis. The market research of Puheloinen is different from this market research but there are some good ideas in the research of Puheloinen. The market research of Puheloinen (2005) was made with a specific product and the market has evaluated in area of foreign country and culture. One idea that could have been used in my research is the case product. It would have allowed researching more detailed information about the mining market. The research would have been able to find out the supply chain for a specific product and look at this through channels for mining industry market.

The research of Puheloinen (2005) includes a very extensive description of market research literature which is very good in the research of Puheloinen. The review of market research literature is shorter in my research but it includes relevant information about research methods and tools. Puheloinen (2005) has collected the data for research from public sources and with interviews. It is described in the research that the interviews had been made with qualitative methods (Puheloinen 2005). However, it is explained that representatives of the Master's thesis order company have participated in the interviews and there has been some product presentation at the same time. This certainly disturbs the qualitative interviews. Also, Puheloinen (2005) told in the research that he did not recorded interviews.

When, I compare the data collection of these two researches there came out some things. The sample is wider in the market research of Puheloinen. The qualitative research methods have been realized well in my research because the interviews were recorded and those were private situations. Even the sample is smaller in my research there is good information about mining industry and it has been possible to make recommendations by data for the order of Master's thesis.

4 CONCLUSIONS AND RECOMENDATIONS

The purpose of this Master's thesis was to create a clear and extensive picture about northern of Fennoscandian and Greenland mining market for Parker Hannifin Oy. Also one aim was to create information of mining market opportunities and threats. This market research will help and support decisions of the decision makers of Parker Hannifin Oy.

One of the research questions was what is the potential in the northern of Fennoscandian and Greenland mining and technology market for Parker Hannifin Oy. On the discussions with Parker managers it came up that they are especially interested to expand their business directly to mining companies. The potential of growth for Parker Hannifin Oy directly to Finnish mining companies is estimated in table five. That table was based on mining levels of Finnish mining industry in 2012. Calculations have been based on the revenue of Parker Hannifin Oy and total rock mining volume of mining companies. The revenue of Finnish corporation was 103 million euro in 2012. The international corporation of Parker Hannifin has calculated the potential sale for mining companies per million mined tons. Estimated percent in table five illustrates how much the revenue of Parker Hannifin Oy could grow with expansion to mining industry. In total the revenue of Parker Hannifin Oy would have been able to grow almost 11 % in 2012.

Table 5. Potential sale of Parker directly for mines in Finland in 2012.

Mining Company	Volume	Hydraulics %	Fluid connectors%	Filtration%	Seals %	Other %	Total %
Agnico-Eagle	3.4 Mt	0.125	0.324	0.037	0.025	0.075	0.586
Beldevere Mining Oy	0.66 Mt	0.024	0.063	0.007	0.005	0.015	0.114
Dragon Mining Oy	0.73 Mt	0.027	0.069	0.008	0.005	0.016	0.125
Lapland Goldminers Oy	0.71 Mt	0.026	0.068	0.008	0.005	0.016	0.123

Altona Mining Ltd	0.73 Mt	0.027	0.069	0.008	0.005	0.016	0.125
Outokumpu Chrome Oy	1.9 Mt	0.069	0.181	0.021	0.014	0.042	0.327
Talvivaara Mining Company Plc	27.3 Mt	0.601	2.003	0.200	0.100	0.601	3.505
Endomines AB	0.38 Mt	0.014	0.036	0.004	0.003	0.008	0.065
Nordic Mines AB	5.1 Mt	0.112	0.374	0.037	0.018	0.112	0.653
Pyhäsalmi Mine Oy (FQM)	1.4 Mt	0.005	0.133	0.015	0.010	0.031	0.194
Kevitsa (FQM)	7.6 Mt	0.167	0.558	0.056	0.028	0.167	0.976
Nordkalk Oy Ab	5.3 Mt	0.121	0.395	0.040	0.020	0.117	0.746
SMA Minerals AB	0.12 Mt	0.003	0.009	0.001	0	0.003	0.016
Yara International ASA	21.4 Mt	0.471	1.570	0.157	0.079	0.471	2.748
Mondo Minerals B.V	3.6 Mt	0.079	0.264	0.026	0.013	0.079	0.461
Paroc Group	0.27 Mt	0.006	0.020	0.002	0.001	0.006	0.035
Sibelco Group	0.16 Mt	0.004	0.012	0.001	0	0.004	0.021
Total							10.82

It has been estimated that Finnish mining industry total rock mining will triple in the next five years so that would mean the potential sales of Parker Hannifin Oy for directly Finnish mines will triple too. This estimate that Finnish mining industry will triple in the next five is maybe a little too optimistic. After that when those evaluations have published a lot has happened in mining industry. The latest news of Finnish mining industry is that Talvivaara is negotiating with workers' lay-off, Hitura has been driven down the production process and a few other mining companies who operate in Finland have a reorganization program. Talvivaara Overlord project has a great share in that Finnish mining industry future growth estimate. It seems that the economic downturn in Europe and the rest of the world affects the financing of new mining and exploration projects. This does not mean, however, that these mining projects will not be materialized. The schedules of these new mining and exploration projects may be delayed. I would recommend for Parker Hannifin Oy that they would evaluate Finnish mining industry sale potential based on the mining statistics in 2012.

Also, the mining industry is growing very fast in Sweden. Swedish mining industry will need 10 000 – 15 000 new employees by the year 2025. That number is two or three times more than the number of employees that Finnish mining industry need in the near future. It is difficult to estimate precisely what the sales potential to the mining industry of Sweden is because of the calculations in this research base on a total rock mining tons of mines. I did not find the total rock mining tons from the other research countries. A mining industry in Norway and Greenland are developing all the time but the mining and technology market is still relatively small. I would recommend to focus on the mining and technology market of Swedish and Finnish Lapland. There will be the highest potential for spare parts business with mining industry in the northern Fennoscandia.

Another research question was what are the best delivery and marketing channels for mining and technology market. The questionnaire and interviews included questions about this topic. Parker Hannifin Corporation has worldwide customers of a different kind in mining industry such as original equipment manufacturers, maintenance and repair organizations and mining companies. This research is focused on potential customers from maintenance and repair organizations and mining companies. There was one question in the research about which a kind of delivery models would be most efficiency and reliable for mining industry. On this question the options was given

which were a site container, a store of spare parts with a self-carrier agreement, a store of spare parts with their own warehouse filling system and a service car. Parker Hannifin uses those delivery models with worldwide customers and this question was applied for Finnish mining industry reviews about delivery models.

Most of the Finnish mining companies have a store of critical spare parts of mining machines. Interviews showed that they gave a value for the quality and efficient delivery of spare parts in Finnish mining industry. Also, one issue that rose up was the availability of spare parts. The Finnish mining companies appreciate the kind of supplier who will be able to respond in a tight schedule for their needs. In total there was responds from seven Finnish mining companies for questionnaires and interviews. Most of those companies have a spare part store. They had experience about agreement where suppliers deliver spare parts directly to store and the supplier is responsible for the adequacy of spare parts. Most of the mining companies were satisfied for a self-carrier delivery system. Two companies told they are not satisfied for the self-carrier systems and they have their own warehouse filling system. Clearly, the Finnish mining companies thought that the best delivery system is a store of critical spare parts but only that warehouse filling system divided the opinions of Finnish mining companies. The questionnaire included a question which spare part delivery systems they have experienced the most effective and reliable. The replies to the questionnaire and interviews have collected on a table six about that question. It is easy to see that the store of spare parts has got most of votes. It is important to note that the Finnish mining companies did not object to these delivery models.

Table 6. Finnish mining companies opinions of spare part delivery systems.

	Efficient and reliable	Developable idea	Difficult to operate
A site container (like a hydraulic hose container)	1	1	0
A store of spare parts with a self-carrier agreement	1	1	1
A service car (like a hose doctor)	1	1	0

A store of spare parts with their own warehouse filling system.	4	1	0
--	---	---	---

Stakeholders of Finnish mining industry had different thoughts about what is the best delivery and marketing systems for the Finnish mining industry. There were two interviews and four people responded to the questionnaire with mining contactors. Most of mining contactors have a store of critical spare parts especially on bigger sites. Those contactors who operate in underground mines told that the products of Parker Hannifin are familiar for them and they use some of the products. In many interviews and questionnaire replies it came up that respondents appreciate the delivery time and reliability of spare parts. Also many respondents of research told that they would like to find new options for the spare parts of mining machines purchasing but the guarantee of equipment and the responsibility issues limit procurement. The opinions of respondents are collected in a table seven about which spare part delivery systems they have experienced the most efficient and reliable. Responds of Finnish mining industry stakeholders are different than responds from mining companies. The major difference is the attitudes of respondents towards a service car system. The stakeholder of Finnish mining industry thought that service car as a delivery system is difficult to operate for them.

Table 7. Opinions of Finnish mining industry stakeholders about spare part delivery systems.

	Efficient and reliable	Developable idea	Difficult to operate
A site container (like a hydraulic hose container)	3	0	1
A store of spare parts with a self-carrier agreement	1	1	1
A service car (like a hose doctor)	1	0	3

A store of spare parts with their own warehouse filling system.	4	0	1
--	---	---	---

It seems that the Finnish mining industry has would like services of the same kind as Parker Hannifin provides in the United States of America. The representative of Parker Hannifin US told that they have directly business only with bigger mining industry customers but generally the business happen via distributors who operate direct with mining companies. The Finnish mining industry normally buys their general spare parts from local stores. I think that for Parker Hannifin Oy the easiest way could be to increase sales by finding co-operation partners from those local stores and contactors who have already business with local mining companies.

The third research question was what are those technologies and mining industry areas where the supply of Parker and the demand for mining industry meet the best. It was difficult to get a clear answer for this question. The most of those respondents who told that the products of Parker Hannifin have been used those in underground mining machines. This is due to the fact that Parker has business with original equipment manufacturers that produce mining machines for underground mining activity. Probably, this is the area where the supply of Parker and the demand for mining industry meet very well. Parker is the easiest answer to this demand because it has this kind of business already in Finland with original equipment manufacturers.

I would like to recommend for a researcher who will work on the same subject that he should research the Swedish mining market which has a lot of potential. One very interesting geographical area is a mining market in Lapland. I would recommend follow up researches to find out what kind of opportunities there are in Swedish and Finnish Lapland. What kind of opportunities there are for the company to serve the mining industry of both countries across borders. The research could limit only for Lapland then it would be possible to find out more detailed market information. Also, I would like to say about something about research methods. The research problem should clearly determined. That helps a lot to all other phases of the research. Also, I would recommend that it would be reasonable to research that where the products of Parker could be used in the mining industry. New technology areas could be found such as

from enrichment factories. At the end I would like to recommend for market researchers that it would be reasonable to use case examples in the market research. Case examples help to create a clear picture of markets and those guide the researcher to form a more detailed picture of the market. It is possible to create a specific picture of a market with case examples. If the market research was accurate, it would reduce the error conclusions of a market research reader. I mean the fact that then there is now room for error conclusions because the picture of the market is so clear and detailed.

5 SUMMARY

This research is a Master's thesis that has produced for Parker Hannifin Oy in the University of Oulu in Department of Process and Environmental engineering. Parker Hannifin Oy ordered the research of the Finnish mining market. A subject was limited research to the northern Fennoscandian and Greenland mining market but the focus was mainly in Finland. The research produced new information of the mining market for the decision makers of Parker Hannifin. The research problem was clarified which delivery models would work with mining industry, what is the business potential with mining industry and which are the technology areas where the supply and the demand meet.

The business potential for Parker Hannifin Oy is huge in Finnish and Swedish mining market. The mining are developing and growing very fast in both countries. It was estimated that Parker could increase its revenue 10 % by sale to Finnish mining industry in 2012. It has been estimated that the production of Finnish mining industry will triple by year 2022. Swedish mining will need 10 000 – 15 000 new employees by year 2025 which two to three times more than Finnish mining industry. It would be reasonable to focus on the mining and technology market on the Finnish and Swedish Lapland. However, these are only estimates and they should be interpreted cautiously. The potential mining industry customers consider that site container and a store of mining company are delivery efficient and effective models. It seems that most of the Finnish mining companies have a store of critical spare parts of mining machines. Parker products are mostly used in underground mining machines in Finland. In the research it came out that for Parker Hannifin Oy the easiest way to increase its sales could be finding co-operation partners from those local stores and contactors who have already business with local mining companies.

One recommend for follow up research is to find out what kind of opportunities there are in Swedish and Finnish Lapland. The research could limit only for Lapland then it would be possible to find out more detailed information of the mining market. Another follow up research area would be to research that where the products of Parker could be used in the mining industry. Those research areas have become acquainted with this research. The time for Master's thesis is limited and that is why these areas have been treated superficially.

REFERENCES

- Agnico-Eagle (2011) Kittilän Kaivos. (web page). 2011 Agnico Eagle Ltd [cited 17.5.2013] Available from: <http://beagnicoeagle.com/index.php?q=fi/kittil%C3%A4n-kaivos>.
- Agnico-Eagle (2013a) Agnico-Eagle report of first quarter 2013 operation and financial results. (web document). Toronto: April 2013 [cited 17.5.2013] Agnico-Eagle Ltd. 22 p. PDF-file available from: <http://www.infomine.com/index/pr/PB306611.PDF>.
- Agnico-Eagle (2013b) Agnico-Eagle reports of fourth quarter and full year results 2012. (web document) Toronto: February 2013 [cited 17.5.2013] Agnico-Eagle Ltd. 34 p. PDF-file available from: <http://www.infomine.com/index/pr/PB282964.PDF>.
- Agnico-Eagle (2013c) Financial Summary. (web page). Date of publication unknown [cited 29.5.2013] Agnico-Eagle Ltd. Available from: http://ir.agnicoeagle.com/files/doc_financials/2012/aem2012ar/index.html.
- Altona Mining (2013a) Our Company – Altona Mining Limited. (web page). Date of publication unknown [cited 23.5.2013] Altona Mining Ltd. Available from: <http://www.altonamining.com/about/our-company>.
- Altona Mining (2013b) Outokumppu copper –project. (web page). Date of publication unknown [cited 23.5.2013] Altona Mining Ltd. Available from: <http://www.altonamining.com/finland/outokumpu-copper-project>.
- Altona Mining (2013c) Roseby copper project. (web page). Date of publication unknown. [cited 23.5.2013] Altona Mining Ltd. Available from: <http://www.altonamining.com/australia/roseby-copper-project>.
- Altona Mining (2013d) Investor Fact Sheet. (web document). Perth: October 2012 [cited 23.5.2013] Altona Mining Ltd. PDF-file available from: http://www.altonamining.com/static/uploads/documents/Company_Investor-FactSheet-Oct__2012-PPR.pdf.
- Belvedere Resources (2013a) Hituran nikkelikaivos. (web page). Date of publication unknown [cited 20.5.2013] Belvedere mining Oy. Available from: <http://www.belmining.com/>.
- Belvedere Resources (2013b) Management's Discussion and Analysis For the Year Ended December 31,2012. (web document) Vancouver: April 2013 [cited 20.5.2013] Belvedere Resources Ltd. 28 p. PDF-file available from: <http://www.belvedere-resources.com/assets/MDA-Dec31-2012.pdf>.
- Berg-Andesson B, Hernesniemi H, Rantala O & Suni P (2011) KALLIOSTA KULLAKSI KUMMUSTA KLUSTERIKSI: Suomen mineraaliklusterin vaikuttavuusselvitys. Helsinki, Etna. 241 p. ISBN 978-951-628-527-9.
- Dragon Mining (2013a) Operations, Overview. (web page). Date of publication unknown [cited 21.5.2013] Dragon Mining Ltd. Available from: <http://www.dragon-mining.com.au/operations/overview>.

- Dragon Mining (2013b) Dragon Mining, Full Year 2012 Results Presentation. (web document). Perth: March 2013 [cited 21.5.2013] Dragon Mining Ltd. PDF-file available from: http://www.dragon-mining.com.au/sites/default/files/1208354_0.pdf.
- Dragon Mining (2012) Operations, Vammala. (web page). September 2012 [cited 21.5.2013] Dragon Mining Ltd. Available from: <http://www.dragon-mining.com.au/corporate/directory>.
- Destia (2013) Destia –Toimivampi maailma. (web page.) Date of publication unknown [cited 23.7.2013] Destia Oy. Available from: <http://www.destia.fi/apunavigaatio/yritys.html>.
- Eilu P (2011) Metallic mineral resources of Fennoscandia. (web document). Espoo: 2011 [cited 16.5.2013] Geoscience for society – 125th anniversary volume, Geological Survey of Finland. 13-21 p. PDF-file available from: http://arkisto.gtk.fi/sp/sp49/sp49_eilu.pdf.
- Endomines (2013a) About Endomines. (web page). Date of publication unknown. [cited 22.5.2013] Endomines AB. <http://www.endomines.fi/endomines.php>.
- Endomines (2013b) Etsintäyhtiöstä kaivosyhtiöksi –Endomines ja Pampalon kultakaivos. (web document). Stockholm: March 2013 [cited 22.5.2013] Endomines AB. PDF-file available from: http://www.endomines.fi/pdf/Endomines_Tampereen_Sijoitusmessut_3_2013_FI.pdf
- Endomines (2013c) Årsredovisning 2012. (web document). Stockholm: April 2013 [cited 22.5.2013] Endomines AB. PDF-file available from: http://files.shareholder.com/downloads/-AMDA-EI7J1/2490814466x0x650441/BF1567FC-785E-4564-B00B-60C6584F2EC7/Endomines_aar2012.pdf.
- E. Hartikainen Oy (2013a) Nykyiset urakat. (web page.) Date of publication unknown [cited 12.6.2013] E. Hartikainen Oy. Available from: <http://www.hartikainen.com/nykyiseturakat.aspx>.
- E. Hartikainen Oy (2013b) Etusivu. (web page.) Date of publication unknown [cited 12.6.2013] E. Hartikainen Oy. Available from: <http://www.hartikainen.com/maarakennus.aspx>.
- E. Hartikainen Oy (2013c) Kalusto. (web page.) Date of publication unknown [cited 12.6.2013] E. Hartikainen Oy. Available from: <http://www.hartikainen.com/sisaltomaarakennus.aspx?menuId=7366&sisaltoid=10834&slideshow=268&backlink=0>.
- First Quantum Minerals (2013a) Overview. (web page). Date of publication unknown [cited 23.5.2013] First Quantum Minerals Ltd. Available from: <http://www.first-quantum.com/Our-Company/overview/default.aspx>.
- First Quantum Minerals (2013b) Operating Mines, Kevitsa. (web page). Date of publication unknown [cited 23.5.2013] First Quantum Minerals Ltd. Available from: <http://www.first-quantum.com/Our-Business/operating-mines/Kevitsa/default.aspx>.

- First Quantum Minerals (2013c) Operating Mines, Pyhäsalmi. (web page). Date of publication unknown [cited 23.5.2013] First Quantum Minerals Ltd. Available from: <http://www.first-quantum.com/Our-Business/operating-mines/Pyhasalmi/default.aspx>.
- First Quantum Minerals (2012) Driving Value. (web document). London: December 2012 [cited 23.5.2013] First Quantum Minerals Ltd. PDF-file available from: <http://www.first-quantum.com/Our-Company/Corporate-Directory/default.aspx>.
- Fraser Institute annual (2013) Survey of Mining Companies. (web document.) Vancouver: February 2013 [cited 6.8.2013] The Fraser Institute. PDF-file available from: <http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/publications/mining-survey-2012-2013.pdf>.
- Greenland (2013) Projects. (web page.) Date of publication unknown [cited 6.8.2013] Greenland Minerals and Energy Ltd. Available from: <http://www.ggg.gl/projects/specialty-metals-kvanefjeld/>.
- Gold Fields Arctic Platinum (2013) Suhangon kaivoshanke. (web document.) Rovaniemi: February 2013 [cited 24.7.2013] Gold Fields Arctic Platinum Oy. PDF-file available from: <http://suhanko.net/category/suhangon-kaivoshanke/>.
- Hague N, Hague P & Morgan C-A (2004) Market Research in Practice: A Guide to the Basics. London, Kogan Page Ltd. 257 p. ISBN 074-944-180-1.
- Juuan Dolomiittikalkki (2013) Etusivu. (web page.) Date of publication unknown [cited 27.5.2013] Juuan Dolomiittikalkki Oy. Available from: <http://www.dolomiittikalkki.fi/etusivu/>.
- Kuntaliitto (2013) Väestötiheys Suomessa. (web document.) Date of publication unknown [cited 6.8.2013] Uusi kunta 2017, Kuntaliitto. Available from: <http://www.kunnat.net/fi/palvelualueet/uusikunta2017/aineistoa/Documents/vaestontiheys-yms.pdf>.
- Kaupapolitiikka (2012) Miten Ruotsi on rakentanut kaivosteollisuuden toimintaedellytykset?. (web page.) Stockholm: November 2012 [cited 5.8.2013] Finnish Embassy. Available from: <http://www.kaupapolitiikka.fi/public/default.aspx?contentid=263462&nodeid=41394&culture=fi-FI>.
- Lapland Goldminers (2013a) Färböleden. (web page) Date of publication unknown [cited 20.5.2013] Lapland Goldminers AB. Available from: <http://www.laplandgoldminers.com/system/visa.asp?HID=1345&FID=1154&HSID=25480&ActMenu=25545>.
- Lapland Goldminers (2013b) There's gold in our mountains (web page). Date of publication unknown [cited 20.5.2013] Lapland Goldminers AB. Available from: <http://www.laplandgoldminers.com/system/visa.asp?HID=1345&FID=1154&HSID=25476>.

- Lapland Goldminers (2013c) Interim report January – December 2012. (web document). Lycksele: February 2013 [cited 20.5.2013] Lapland Goldminers AB. 19 p. PDF-file available from: http://www.bequoted.com/investor/company/documents/laplandgoldminers_bokslut_2012_130221_eng.pdf.
- Lemminkäinen (2013a) Maanalainen rakentaminen. (web page.) Date of publication unknown [cited 20.6.2013] Lemminkäinen Oy. Available from: <http://www.lemminkainen.fi/Ammattilaiset/Maanalainen-rakentaminen/>.
- Lemminkäinen (2013b) Lemminkäinen sijoituskohteena. (web page.) Date of publication unknown [cited 20.6.2013] Lemminkäinen Oy. Available from: <http://www.lemminkainen.fi/Lemminkainen/Sijoittajat/Lemminkainen-sijoituskohteena/>.
- Lemminkäinen (2013c) Avainluvut. (web page.) Date of publication unknown [cited 20.6.2013] Lemminkäinen Oy. Available from: <http://www.lemminkainen.fi/Lemminkainen/Sijoittajat/Avainluvut/>.
- London Mining (2013) Operations, Isua –Greenland. (web page.) Date of publication unknown [cited 6.8.2013] London Mining Ltd. Available from: <http://www.londonmining.com/operations/greenland/>.
- McPhee N (2008) Business to Business Research, In: Hamersveld M & Bont C, Market Research Handbook (5th Edition). Hoboken, NJ, USA; Wiley. 251-266 p. ISBN 978-047-051-768-0..
- Mondo Minerals (2013) Global Locations. (web page). Date of publication unknown. [cited 27.5.2013] Mondo Mineral B.V. Available from: <http://www.mondominerals.com/en/the-talc-company/global-locations/>.
- Nordic Mines (2013a) Annual Report 2012. (web document). Uppsala: May 2013 [cited 23.5.2013] Nordic Mines AB. PDF-file available from: http://www.nordicmines.com/sites/default/files/NordicMines_2012_GB_web.pdf.
- Nordic Mines (2013b) Projektit (web page). Date of publication unknown [cited 23.5.2013] Nordic Mines AB. Available from: <http://www.nordicmines.com/fi/projektit>.
- Nordkalk (2013a) Nordkalk Group in Brief. (web page). Date of publication unknown [cited 24.5.2013] Nordkalk Oy Ab. Available from: <http://www.nordkalk.com/mine>.
- Nordkalk (2013b) Suomi. (web page). Date of publication unknown [cited 24.5.2013] Nordkalk Oy Ab. Available from: <http://www.nordkalk.fi/default.asp?viewID=974>.
- Norskbergindustri (2013) Strategy for the Mineral industry. (web document.) Oslo: July 2013 [cited 6.8.2013] Norwegian ministry of trade and industry. PDF-file available from: <http://www.norskbergindustri.no/english/english-translation-of-the-norwegian-strategy-for-the-mineral-industry>.
- Omya (2013b) Group. (web page.) Date of publication unknown [cited 27.5.2013] Omya AG. Available from: <http://www.omya.fi/C125728900639D06/direct/Home>.

- Omya (2013a) World of Omya, Omya in Finland. (web page.) Date of publication unknown [cited 27.5.2013] Omya AG. Available from: <http://www.omya.fi/C125728900639D06/direct/Home>.
- Outokumpu (2013a) Outokumpu Suomessa. (web page). Date of publication unknown [cited 20.5.2013] Outokumpu Oyj Available from: <http://www.outokumpu.com/fi/Outokumpu/Suomessa/Sivut/default.aspx>.
- Outokumpu (2013b) Taloudellinen katsaus vuonna 2012. (web document). Date of publication unknown [cited 21.5.2013] Outokumpu Oyj. PDF-file available from: <http://outokumpu-reports.studio.crasman.fi/file/dl/i/lufpqA/IRPeEq7p1LVhZwd4-JWXeaA/Taloudellinenkatsaus.pdf>.
- Outokumpu (2013c) Outokumpu, Tuotantoprosessi Torniossa ja Kemin kaivoksella. (web document). Date of publication unknown [cited 21.5.2013] Outokumpu Oyj. PDF-file available from: http://www.outokumpu.com/Site-CollectionDocuments/Tornio_animaatio_printiversio.pdf.
- Paroc (2013) About Paroc. (web page.) Date of publication unknown [cited 27.5.2013] Paroc Group. Available from: <http://www.paroc.com/about-paroc>.
- Phillips A (2008) What is Market Research?, In: Hamersveld M & Bont C, Market Research Handbook (5th Edition). Hoboken, NJ, USA; Wiley. 37-64 p. ISBN 978-047-051-768-0.
- Pokki J (2013) Tilastotietoja vuoriteollisuudesta 2012. Materia (2/2013), p. 79-80. ISSN 1459-9694.
- Puheloinen T (2005) Electric motor and frequency converter markets in Latin America and especially in the mining industry of Chile. (web document). Helsinki: March 2005 [cited 28.8.2013] Lappeenranta University of Technology. PDF-file available from: <http://www.doria.fi/bitstream/handle/10024/34408/nbnfife200811052053.pdf?sequence=1>.
- Rettig Group (2013a) Annual Report 2012. (web document). Date of publication unknown [cited 24.5.2013] Rettig Group Oy Ab. PDF-file available from: http://www.rettig.fi/files/rettig/pdf/Rettig_AR_2012.pdf.
- Rettig Group (2013b) Nordkalk. (web page). Date of publication unknown. [cited 24.5.2013] Rettig Group Oy Ab. Available from: http://www.rettig.fi/nordkalk_en.
- Rotator (2013) Perustiedot. (web page.) Date of publication unknown [cited 20.8.2013] Rotator Oy. Available from: <http://www.rotator.fi/fi/yritys/perustiedot/>.
- Rudus (2013a) Yritys. (web page.) Date of publication unknown [cited 27.5.2013] Rudus Oy. Available from: <http://www.rudus.fi/yritys>.
- Rudus (2013b) Toimialat. (web page.) Date of publication unknown [cited 27.5.2013] Rudus Oy. Available from: <http://www.rudus.fi/yritys/toimialat>.

- Sibelco Group (2013a) About Us. (web page.) Date of publication unknown [cited 27.5.2013] Sibelco Group. Available from: <http://www.sibelco.com/index.php/about-us>.
- Sibelco Group (2013b) Id-card. (web page.) Date of publication unknown [cited 27.5.2013] Sibelco Group. Available from: <http://www.sibelco.be/>.
- SMA Mineral (2013) SMA mineral tuottaa kalkkia ja dolomiittia. (web page). Date of publication unknown [cited 24.5.2013] SMA Mineral Ab. Available from: http://www.smamineral.fi/SMA_Mineral.aspx.
- Suomen virallinen tilasto (SVT) Kansantalous. (web document). Helsinki: March 2013 [cited 17.5.2013] Suomen virallinen tilasto, Tilastokeskus. Available from: http://www.stat.fi/tup/suoluk/suoluk_kansantalous.html#bkttoimialoittain.
- Tallqvist (2013a) Esite. (web document.) Date of publication unknown [cited 20.6.2013] Tallqvist Oy AB. PDF-file available from: http://www.tallqvist.fi/files/Esite_2013.pdf.
- Svemin (2012) A vision of growth of the Swedish mining industry. (web document.) Stockholm: September 2012 [cited 5.8.2013] Svemin. PDF-file available from: http://www.hannansreward.com/reports/121016-Svemin_minirapport_eng_5.pdf.
- Talvivaara (2013a) Toiminta, Mineraalivarannot. (web page). Date of publication unknown [cited 21.5.2013] Talvivaara Mining Company Plc. Available from: <http://www.talvivaara.com/toiminta/mineraalivarannot>.
- Talvivaara (2013b) Talvivaara Mining Company annual results review for the year ended 31 December 2012. (web document). Espoo: February 2013 [cited 21.5.2013] Talvivaara Mining Company Plc. PDF-file available from: http://www.talvivaara.com/files/talvivaara/FY2012/Talvivaara_annual_results_review_for_the_year_ended_31_Dec_12_14.2.2013.pdf.
- Talvivaara (2013c) Hallitusti uuteen nousuun, Vuosikertomus 2012. (web document). Date of publication unknown. [cited 21.5.2013] Talvivaara Mining Company Plc. 157 p. PDF-file available from: http://www.talvivaara.com/files/talvivaara/AR%202012/Talvivaara_VSK_20-12.pdf.
- Tapojärvi (2013a) Referenssit. (web page). Date of publication unknown [cited 23.5.2013] Tapojärvi Oy. Available from: <http://www.tapojarvi.com/referenssit>.
- Tapojärvi (2013b) Kalusto. (web page). Date of publication unknown [cited 20.6.2013] Tapojärvi Oy. Available from: <http://www.tapojarvi.com/kalusto>.
- Toivanen (2013) Yritys. (web page.) Date of publication unknown [cited 22.7.2013] Veljekset Toivanen. Available from: <http://www.veljeksettoivanen.fi/yritys.html>.
- Uusisuo M (2013) The Mining Industry. (web document). Helsinki: January 2013 [cited 29.5.2013] Ministry of Employment and the Economy. 101 p. PDF-file available from: http://www.temtoimialapalvelu.fi/files/1796/Mining_Industry.pdf.

- Yara International (2013) Creating value by developing profitable sustainable growth. (web document). Date of publication unknown [cited 24.5.2013] Yara International ASA. PDF-file available from: http://www.yara.com/doc/64851_Yara%20FR%20komplett.pdf.
- Yara Suomi (2013a) Yara Suomessa. (web page). Date of publication unknown [cited 24.5.2013] Yara Suomi Oy. Available from: http://www.yara.fi/about/yara_in_finland/index.aspx.
- YIT (2013a) Etusivu. (web page.) Date of publication unknown [cited 20.6.2013] YIT Oyj. Available from: <http://www.yit.fi/>.
- YIT (2013b) Infrapalvelut. (web page.) Date of publication unknown [cited 20.6.2013] YIT Oyj. Available from: http://www.yit.fi/yit_fi/Infrapalvelut/kalliorakentaminen-ja-kaivokset.
- YIT (2013c) Avainluvut. (web page.) Date of publication unknown [cited 20.6.2013] YIT Oyj. Available from: http://www.yit.fi/yit_fi/Tietoa_YITsta/sijoittajat/Avainluvut.
- YIT (2013d) Osake. (web page.) Date of publication unknown [cited 20.6.2013] YIT Oyj. Available from: http://www.yit.fi/yit_fi/Tietoa_YITsta/sijoittajat/Osake.
- Yle (2010) Mondo Minerals avasi uuden kaivoksen Sotkamoon. (web page.) Kainuu: October 2010 [cited 27.5.2013] Yle Uutiset. Available from: http://yle.fi/uutiset/mondo_minerals_avasi_uuden_kaivoksen_sotkamossa/5652409.
- Yle (2012) Grönlannilla massiivisia kaivossuunnitelmia. (web video.) Helsinki: October 2012 [cited 6.8.2013] Yle Areena. Video available from: <http://areena.yle.fi/tv/1695342>.
- Yle (2013) Hinta romahdus pakotti Talvivaaran kymmenien miljoonien säästökuurille. (web page.) Helsinki: July 2013 [cited 13.8.2013] Yle Uutiset. Available from: http://yle.fi/uutiset/hintaromahdus_pakotti_talvivaaran_kymmenien_miljoonien_saas_tokuurille/6715483.

APPENDIX 1

Questions for interviews of Parker Hannifin Oy

Backgrounds:

1. Name, Title, Education, History of Career, Responsibilities

Products of Parker Hannifin Oy:

2. What kind of products involved are currently working on?
3. What are the current supply and sale channels?
4. Could tell something about the contracts and delivery methods?
5. How does the new customer process usually goes? Or is there any generally applicable process?
6. How much do you know about our customers?
7. Could tell me about how the standards are linked to your work? Like ISO 14001, ISO 9001, CE-marks, EX? Can you tell me about them? Is there any limitations?

The mining industry:

8. What kind of things do you need to know about the client?
9. What kind of information of the potential for mining customer makes your work easier?
10. What do you know and what kind of experience you have the mining industry?
11. What do you think about what kind of delivery and sales channels could work?
12. What kind of information you will usually make clear for yourself before you meet a new client?
13. What kind of products Parker Hannifin Oy could provide for mining industry?
Tell your opinion.

APPENDIX 2

The questionnaire for Parker Hannifin Ltd.

This research includes ten open questions about Parker and Mining industry.

1. Name, position, education?
2. How you are linked to mining industry and what is your role in Parker?
3. What are generally products and service that Parker sells and marketing for mining industry?
4. What kind of customers Parker has in mining industry?
5. What are the main delivery and marketing channels directly to mines?
6. What are the main sales channels and products quantitatively?
7. What are the main sales channels and products commercially?
8. Several international mining and explorations companies are operating in Finland.

Those are:

Altona Mining Ltd.	Agnico-Eagle Ltd.	Belvedere Resource Ltd.
Lapland Goldminers AB	Dragon Mining Ltd.	Endomines AB
First Quantum Minerals Ltd.	Nordic Mines AB	SMA Mineral AB
Mondo Minerals B.V	Omya Ltd.	Sibelco Group
Yara International ASA	Northland Resources S.A.	Anglo American plc.
Mawson Resources Ltd.	Nordic Mining ASA	

If you know, could you tell about co-operations or trade between Parker and any of those mining and exploration companies?

9. Please tell your opinion about future trends in mining. Like do you have an opinion about what the mines want and expected of mining machinery in future? Or what kind of demand has increased recently in the mining industry?

Thank you for responding! If there is something else that you would like to tell me to help my research, please let me know about it. And please, sent the answers to my email kimmo.mantila@xxxxx.xxx

APPENDIX 3

Questions of interviews for a Finnish mining industry

1. Name, backgrounds, title/status and education
2. Could you tell briefly about your job?
3. Could you briefly tell about the company?
4. How the company is organized mining works? What companies are doing what?
5. What kind of mining machines company has?
6. How to the machinery maintenance is organized?
7. Do you have co-operations with contactors in machine maintenance?
8. Where you buy hydraulic hoses and connectors? Do you have any long-term agreements about those? Do have you organized a competitive tendering of spare parts suppliers?
9. What kind of other industrial equipment you have?
10. How the procurement process of company goes?
11. What kinds of supply /delivery models are familiar for you? For example, a site container? After-sales services? What kind of operation and delivery models have experienced the best and the most reliable?
12. Do you prefer use a local maintenance services or the larger service companies?
13. What are the standards, laws, etc. which limiting your purchasing activities?
14. What kind of investment do you have coming up?
15. Are there any Parker Hannifin's products which are generally familiar to you, like hoses, fittings, filters, or other products?
16. How you see the future? What you wish for future mining equipments?

APPENDIX 4

Questions of questionnaires for the Finnish mining industry

1. Name:

2. Position:

Manager/Engineer/Supervisor/Employee

3. Industry field:

*Mine maintenance/ Factory maintenance/ Mining production/ Factory production
/Management /Research and Development*

4. Could you tell briefly about your work?

5. Is those Parker Hannifin's products are generally familiar to you, like hoses, fittings, filters, hydraulic, pneumatic, or other products?

Yes, we use those/ No/ Yes, but do not use those

6. How the company has organized mining works?

Company does not use contractor / Contractor is responsible for part of mining operations / Contractor is responsible for all mining operations.

7. What works contractors are responsible for?

8. What kind of mining equipment company has?

9. How the mining equipment maintenance is organized?

10. Do you prefer use local maintenance services or the larger service companies?

11. Is there any maintenance co-operations between parent company and contractor?

Yes/No

12. How to availability of spare parts for mobile equipment is secured?

13. Where do you buy hydraulic hoses and connectors for a mining machines?

From a local store, which are__ / The maintenance company handle those / The manufacturer of machinery is our supplier

14. Do you have organized a competitive tendering of spare parts? *Yes/ No*

15. What parts delivery models do you have experienced efficient and reliable?

a site container/ a spare part store without self-carrier agreements / a spare parts store with self-carrier agreement/ service car

16. Could you tell briefly about what kind of investments do you have in the near future?

17. How you see a future and what do you expect for next generation mining machines?