

Finnish shipping requirements in 2025 - a megatrend approach

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ABSTRACT

Objectives of the Study

The purpose of the study is to estimate the Finnish industry requirements for shipping activities in 2025. Megatrends and industry trends are used to estimate the industry development.

Academic background and methodology

The study focuses on the future foresight literature and industry specific visions. Industry development and transportation requirements are analyzed on the basis of megatrends and industry trends. The thesis focuses on the development of metal and mining industry, chemical industry, forest industry, technological industry and the commerce sector.

In addition to the literature review, industry sector development and transportation requirements are discussed in the steering group of "LAIVA 2025" project.

Findings and conclusions

Energy-efficiency and versatility of vessels are crucial for future shipping. Tightening environmental legislation and increasing fuel costs drive companies to improve energy-efficiency. Furthermore, the Finnish industry is expecting to find competitive advantage in small volume niche products instead of mass products which increases the need for agile transportation channels. Versatility of vessels is also highlighted due to shorter technological and economic trends. The shorter the trends, the more often the sea cargo will change. Future vessels need to adapt to changing transportation requirements easily.

It is also found out in the study that technical vessel design issues are important when designing flexible transportation but equally important are issues related to transportation companies' business models. Business models that support flexible manufacturing and high customer service level are the ones likely to succeed. Sea transportation should be seen as an extension to the manufacturing.

Keywords

Megatrend, shipping, future foresight

ABSTRAKTI

Tutkimuksen tavoitteet

Tutkimuksen tavoitteena on selvittää millaiset Suomen teollisuuden vaatimukset ovat laivaliikenteelle vuonna 2025. Työ käsittelee eri toimialojen kehitystä megatrendien ja toimialakohtaisten kehityssuuntien avulla.

Kirjallisuuskatsaus ja metodologia

Tutkimuksessa on perehdytty tulevaisuuden tutkimukseen liittyvään kirjallisuuteen sekä toimialakohtaisiin tulevaisuuden visioihin. Näiden perusteella on luotu viitekehys, jonka puitteissa on analysoitu toimialan kehitystä ja kuljetustarvetta. Työssä tutkittavat toimialat ovat kaivosteollisuus, kemianteollisuus, metsäteollisuus, teknologiateollisuus ja kaupanala.

Kirjallisuuskatsauksen lisäksi toimialojen kehitystä ja kuljetustarpeen muutoksia on käsitelty LAIVA 2025 – projektin ohjausryhmässä.

Tulokset ja päätelmät

Tulevaisuuden laivaliikenteessä keskeisiä tekijöitä ovat energiatehokkuus ja laivojen monikäyttöisyys. Kiristyvät ympäristövaatimukset ja polttoaineiden hinnannousu edellyttävät laivakuljetusten energiatehokkuutta. Laivaliikenteen ja Suomen teollisuuden tuotantorakenteen odotetaan muuttuvan. Tulevaisuudessa Suomen teollisuuden oletetaan keskittyvän massatuotannon sijasta pienempi volyymisten ja korkean lisäarvon omaavien tuotteiden tuottamiseen. Laivojen monikäyttöisyyttä puoltaa myös se, että tulevaisuudessa teknologisten ja taloudellisten trendien oletetaan olevan huomattavasti nykyistä nopeampia. Tulevaisuuden laivan tulee pystyä vastaamaan nopeasti muuttuviin kuljetustarpeisiin.

Teknisen laivasuunnittelun ohella kuljetusyritysten liiketoimintamallit ovat keskeisiä joustavan tuotannon kannalta. Tulevaisuudessa liiketoimintamallit, jotka tukevat joustavaa tuotantoa ja korkeaa asiakaspalvelua, tulee menestymään. Tutkimukseni mukaan merikuljetukset tulisi integroida tulevaisuudessa kiinteämmin osaksi tuotantoketjua.

Avainsanat

Megatrendit, laivaliikenne, tulevaisuus

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1 Introduction

1.1 Purpose of the study and goals

The thesis is conducted as part of the “LAIVA 2025” project which aims at generating alternative and optimal vessel concepts for future dry cargo transportations in Finnish foreign trade, considering changes and factors affecting the operational environment. The project is funded by the Finnish Funding Agency for Technology and Innovations (TEKES) and following industrial companies: Cargotec Finland Oy, ESL Shipping Oy, Oy Langh Ship Ab, Outokumpu Stainless Oy, Stora Enso Oyj and Wärtsilä Oyj. The purpose of the Master’s thesis is to evaluate and estimate the Finnish industry circumstances in 2025 based on the megatrend analysis and industry trends. Additionally, two naval engineering Master’s theses are conducted with the object to design the optimal vessel concept for the Finnish industry requirements in 2025.

There have been tremendous structural changes in the Finnish industry during the last decades. Electronics industry has cut the production in Finland and the forest industry has adjusted its production capacity to meet the decreased demand for paper products. The transportation industry is not only affected by the structural change in the Finnish industry, but the increasing environmental legislation poses challenging too. Despite the ongoing changes, the transportation industry framework is likely to be different in 2025 than nowadays. Due to the long investment period, future shipping requirements should already be taken into account when deciding on the investments. The purpose of the thesis is to predict the drivers that have an effect on the maritime shipping development.

The thesis is based on the literature review and working group discussions. Five industries will be discussed in the thesis, which were selected based on the first working group discussion. Megatrends are used to forecast how the business environment of selected industries could change until 2025. Generally, megatrends are analyzed to identify change factors influencing the future business environment and social factors which could have an effect on the industry development (Nurmi, Vähätalo, & Saarimaa, 2011). To understand the industry specific development, I have discussed the future outlooks of different industries based on the megatrends but also on the industry’s specific publications. Possible development paths were discussed in the working group meetings. After having discussed the industry development, the overall development of the Finnish industry was summarized to analyze the maritime transportation requirements in 2025.

The top-down approach has certain limitations. It is very difficult to estimate how global megatrends will form and appear in the future shipping. It is impossible to justify certain vessel design features or technical details based on megatrends. Megatrends will evolve in the future and there will be new megatrends as well. Nevertheless, megatrends could be used to estimate the possible future states that will affect the transportation requirements. The megatrend analysis is a method to produce data to support the strategic decision making.

The thesis consists of four chapters. Megatrends are discussed in the second chapter. The chapter gives an insight to the fundamentals of the megatrends based future foresight. Global megatrends and transportation industry specific megatrends are discussed in the chapter. The third chapter focuses on the industry development in five different industries – metals and mining, chemical, forest, pulp and paper, technology and commerce. In each subsection, the industry overview is introduced where after the industry development is evaluated. Chapter four summarizes the development of discussed industries and estimates the shipping requirements in 2025.

2 Future foresight

It has always been very difficult to predict the future and there is no sign about the change. Very often the predictions have totally failed. The founder of IBM, Thomas Watson, stated in 1943 that there would be markets for five computers in the worlds. History has shown that the markets were remarkable wider than that. Today's predictions of the future state are neither likely to realize for sure. According to Dator (2012), futurists forecast alternative futures. Forecasts are logical and useful statements about the futures. Dator also states that there is not a single future but several futures, which are alternative and diverse.

Despite the high risk of the forecast not to realize, future foresights are still done. The future foresight is not to estimate the computer markets in 2025 but to produce data to support the strategic decision making. Nurmi et al. (2012) state that one method to estimate the future roadmap is mapping of the operational environment. Mapping is done by analyzing trends and their effect on the research topic. Aaltonen and Noorkõiv (2003) have argued that in a world, where changes are quicker than ever before, stable and linear models fails to predict the future. They argue that foresights bring awareness of the long-term challenges and opportunities in the decision-making.

Indeed, the future will be more fragmented and the world will change faster than nowadays. Some scholars characterize the future by word scarcity whereas the others regard abundance a better word to describe the world. Some say that there will be major changes in our society whereas some forecast only incremental changes. These different views already highlight the fact that there won't be one single answer to the Finnish industry development until 2025. The purpose of the thesis is not to estimate how the world would look like in 2025, but to identify how certain drivers would affect the industry development until 2025. (Wilenius & Kurki, 2012)

In the following, I am going to discuss the megatrend definition and megatrend dynamics. After the introduction to megatrend, megatrends affecting the Finnish industry are discussed.

2.1 Megatrend definition

The megatrend concept was initiated by Naisbitt in 1982. According to Naisbitt and Arbudene megatrends are great forces in human and technology development that have an effect on the human activity in the future, more precisely in a time horizon from 10 to 15 years (Güemes-Castrorena, 2009). Due to the long time horizon and global sphere of interest, megatrends will not be changed quickly (Nurmi, Vähätalo, & Saarimaa, Magneettiteknologiaklusteri 2020, 2011). According to Nurmi et al. (2011), megatrends are global phenomena which have different causes in different

regional levels and in different industries – somewhere the megatrends could increase the wealth whereas elsewhere the effect might be completely different. However, the influence of megatrends in our society is not that simple or straightforward. Some megatrends will have direct consequences on the society, whereas the influence of some other megatrend might seem less important. The megatrends, which seem to be less important, could, however, generate other megatrends potentially changing the world dramatically. Megatrends do not need to be consequent; they could also be contradictory or even contrary with each other.

Megatrend analysis is not the only method to forecast the future development but the trend extrapolation and megatrend analysis are regarded as one of the most established forecasting tools. According to Popper (2008), these two methods provide some type of framework on how the past and present development may look in the future, assuming the future is a continuation of the present. Other methods to foresee the future are for example the Delphi method, scenarios and futures workshops. The Delphi method involves repeated polling of the same individuals while feeding back occasionally responses from the previous polls. The method of a futures workshop also includes expert panelists and the possible future states are forecasted by discussion, presentations and debates. Compared with the future workshop method, the Delphi method is more structures and process oriented. In the scenario approach, constructed views of the possible future states are built in form of a story. According to Shell, scenarios consider plausible futures and how they would emerge from the realities of today (Royal Dutch Shell). Popper has listed a more complete summary of the different forecasting methods in his article (Popper, 2008).

Which method would then be the best one to estimate the transportation requirements in 2025? One essential reason for the megatrend analysis is the assumption of the continuum. Popper noted, the megatrend analysis is a good way to forecast the future in case of the continuous future development. Due to the short forecasting period, 12 years, and the fleet structure in the Baltic Sea, the assumption that the future shipping environment is a continuation of the current shipping activities is valid. According to DNV report (Det Norske Veritas, 2010) it takes about ten years to replace 25 % of the fleet in the Baltic Sea. Thus, approximately 75 % of the current fleet is operating still in 2025. Why then to forecast the future if the fleet in 2025 is similar to the current one? As it takes about ten years to renew the 25 % of the fleet, it is very important to act proactively to market changes. A vessel built in 2013 is likely to operate still in 2050. However, the business environment might differ markedly from the current one.

2.2 Megatrend dynamics

As described earlier, megatrends are phenomena which affect people and technology all around the world. To understand the effect of the megatrend on the industry or on the local business environment, megatrends could be categorized into gigatrends, megatrends and metatrends. Next, I am going to discuss the attributes of each segment. Gigatrend is the upper concept of a megatrend. Gigatrends are the “*fundamental reasons*” behind the megatrends, which change extremely slowly. They appear similarly around the world. Giga- and megatrends forecast what the business environment will look like in the future. These trends are not static but they will change in time. The interplay between different giga- and megatrends allow new trends to emerge. Ahvenainen et al. have described these weak emerging signals as “*metatrends*”. With the time, metatrends could further evolve to mega- or gigatrends. (Ahvenainen, Hietanen, & Huhtanen, 2009)

Metatrends are important when predicting the future business environment. Ahvenainen et al. (2009) state that the goal of the futures studies is to find anomalies which would indicate the underlying megatrend patterns. If megatrends were found by exploring global phenomena, metatrends are more difficult to identify. They represent metaknowledge, weak signals that are not currently common knowledge, but which might evolve to global phenomena in the future. These insights of the future help executives to plan their strategies. Knowing the business environment in a forehand would definitely be valuable for every company. If a company knew the ship requirements of 2050, the current ship investment would be much easier.

2.3 Identified megatrends and gigatrends

In previous chapters I have discussed methods to forecast the future development. In addition, the basics and dynamics of megatrend were discussed in the previous chapters. Hereinafter I am going to review gigatrends and globally important megatrends. Gigatrends, i.e. the global *fundamental reasons*, are discussed first, where after I am going to focus on the global megatrends. As the global trends are known, I will focus more on those mega- and metatrends that will have an effect on the transportation.

Ahvenainen et al. indentify three gigatrends:

- 1) population growth,
- 2) economic growth and
- 3) technologic development (Ahvenainen, Hietanen, & Huhtanen, 2009).

In addition to these three gigatrends, I am going to discuss the “speed-up” as one gigatrend because it has several remarkable outcomes to our society and it can be found behind many phenomena.

2.3.1 Population growth

The world population increased radically in the 20th century. In 1900 the world population was 1.6 billion and in 2000 there were 6.1 billion inhabitants globally. The population has increased especially in Asia, Africa and Latin America and the highest growth rates are expected to be seen these countries also in the future. The population is forecasted to grow by 45 million in the next 20 years in Asia and by 22 million in Africa. Contrary to Asia and Africa, western countries are expected to face much slower growth rates in the next decades. (Ahvenainen, Hietanen, & Huhtanen, 2009)

Not only the rapid population growth, but also other demographic changes are expected. Citizens in western countries are aging to which the economic and social systems need to react. The EU population by age and sex is depicted in Figure 1. As we can see from the figure, in 2008 the median age of an EU citizen was 40-44 years but in 2060 it is forecasted to be 45-49 for males and 70-74 for females. In 2060 differences between age groups between 20 and 80 years are smaller than in 2008. Furthermore, the age groups which are active in working life are smaller in the future. According to a study, there will only be two active workers for each pensioner. This is a major challenge for the economic growth and social infrastructure. Without technological innovations it will become more difficult to obtain economic growth that will improve the well-being. (Directorate-General for Energy and Transport, 2009)

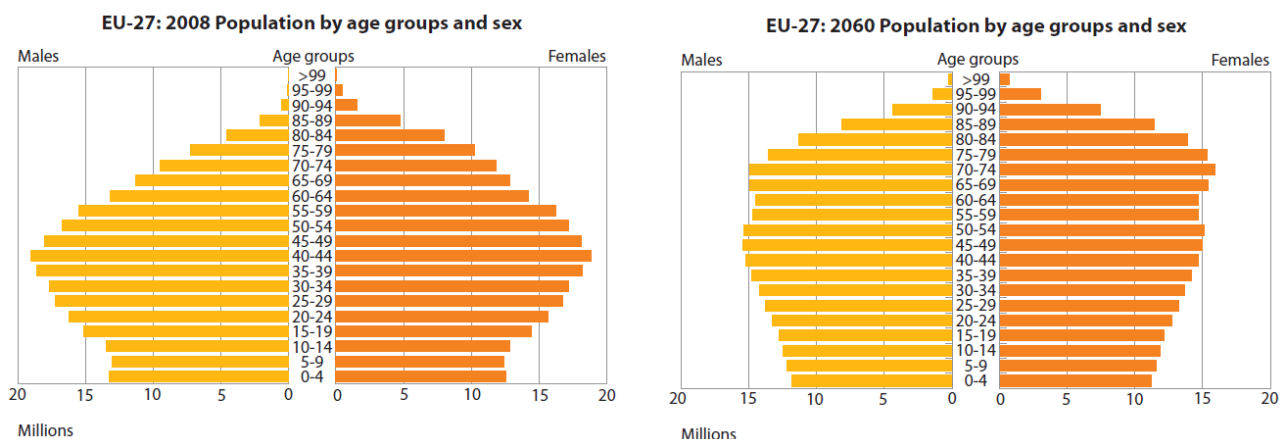


Figure 1 Population in EU-27 in 2008 and 2060. Source (Directorate-General for Energy and Transport, 2009)

2.3.2 Economic growth

The global gross domestic product (GDP) was approximately 80 trillion US dollars in 2011. The world economy has been growing during the last century for almost every year. Between 1980 and 1990 the GDP growth was in Europe 2.4 % annually and between 1990-2008 2.2 %. According to the World Energy Council (2011) the GDP is expected to continue grow in the future but the pace of the growth is likely to differ in different markets. The economic growth will slow down in the EU between 2008 and 2035, whereas in Asian countries, India and other non-OECD countries the growth is expected to be rapid Figure 2. Figure 2 depicts the projected economic growth rates in selected countries until 2035.

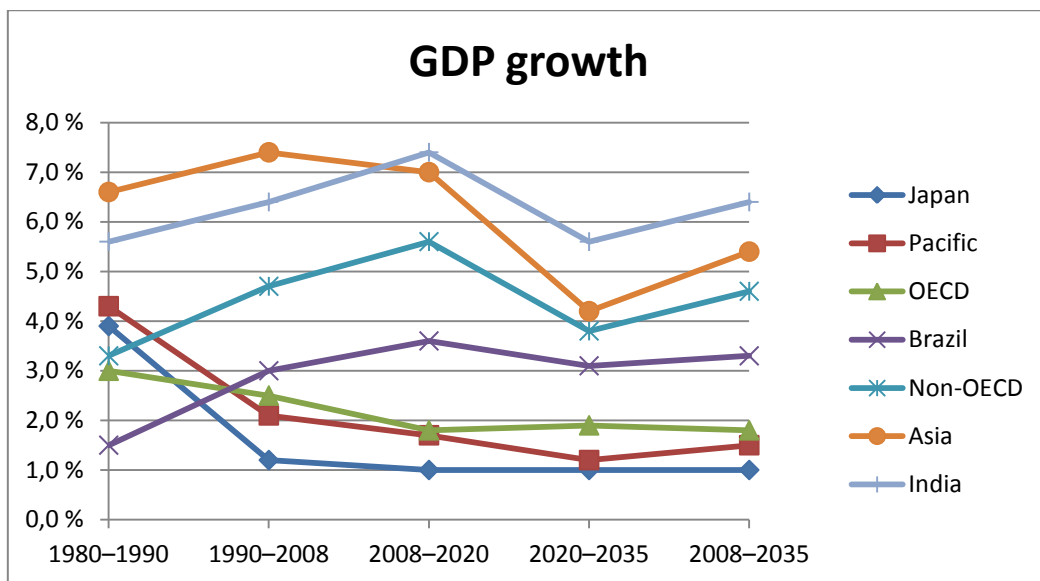


Figure 2 GDP growth in selected regions. Source (World Energy Council, 2011)

Table 1 shows more detailed projections of the economic growth in different locations.

Table 1 IEA estimates of GDP growth in different time periods. (World Energy Council, 2011)

	1980-1990	1990-2008	2008-2020	2020-2035	2008-2035
OECD	3.0 %	2.5 %	1.8 %	1.9 %	1.8 %
North America	3.1 %	2.8 %	2.1 %	2.2 %	2.2 %
US	3.2 %	2.8 %	2.0 %	2.1 %	2.1 %
Europe	2.4 %	2.2 %	1.5 %	1.8 %	1.6 %
Pacific	4.3 %	2.1 %	1.7 %	1.2 %	1.5 %
Japan	3.9 %	1.2 %	1.0 %	1.0 %	1.0 %
Non-OECD	3.3 %	4.7 %	5.6 %	3.8 %	4.6 %
East Europe	4.0 %	0.8 %	3.0 %	3.1 %	3.1 %
Russia	-	0.6 %	2.9 %	3.1 %	3.0 %
Asia	6.6 %	7.4 %	7.0 %	4.2 %	5.4 %

China	9.0 %	10.0 %	7.9 %	3.9 %	5.7 %
India	5.6 %	6.4 %	7.4 %	5.6 %	6.4 %
Middle East	-1.3 %	3.9 %	4.0 %	3.8 %	3.9 %
Africa	2.3 %	3.8 %	4.5 %	2.8 %	3.5 %
Latin America	1.2 %	3.5 %	3.3 %	2.7 %	3.0 %
Brazil	1.5 %	3.0 %	3.6 %	3.1 %	3.3 %
World	3.1 %	3.3 %	3.6 %	2.9 %	3.2 %

As we can see from Table 1, the GDP growth is projected to be the fastest between 2008 and 2035 in India (6.4 %) and China (5.7 %). Estimated GDP growths are 5.4 % in Asia and 4.6 % in Non-OECD countries. Meanwhile in Europe and North America, the projected GDP growths are 1.6 % and 2.2 % respectively. These figures indicate that the future economic growth is going to happen in Asia and Non-OECD countries whereas the economic growth will slow down in western countries. This is likely to change the future business environment remarkably.

2.3.3 Technological development

Technological development has been the most crucial enabler of the wealth augmentation in the past. There are no signs of decreasing importance of technology in the future – on the contrary, technology is regarded increasingly crucial source of wealth in the future world. Technological development is enabled by the new scientific knowledge and information the mankind has. Technological development bundles the available knowledge in a form, which can be delivered to the customers (European Environment Agency, 2011). There is no doubt whether technological development should be regarded as a gigatrend or not. The study of the EEA also emphasizes the stability of the technological development trend but also notes that the speed of the development varies. It is stated in EEA’s global megatrend study (European Environment Agency, 2011) that:

“The general acceleration of innovation and technological change is a stable trend. But the concrete direction and speed of innovation and diffusion is very uncertain.”

I regard this statement very wise. The technology is definitely going to proceed, but we cannot place the most important innovations in a time line in advance. During the time of enlightenment, philosophers assumed the technology to develop, but they would not have been able to place innovations such as spinning jenny or steam engine in a time line. During the last decades the technology has mainly be driven by the ICT technology development, but in the future there might be new drivers to boost the technology development. There is always uncertainty related to technical innovations but new technical innovations will emerge when the future generations want

to fulfill their needs, wants and wishes. The future technological development is especially needed to match the limited resources with regard to the economic growth and population growth.

2.3.4 Speed-up

Despite the fact that Ahevenaine et al. do not recognize the speed-up as a gigatrend but rather as an emerging metatrend, I consider that the speed-up should be considered as a gigatrend. The speed-up can be seen not only associated to the technology development but also to many cultural and societal changes.

According to Kurzweil (2001), the history of the technological progress has shown that the technological change is not linear but exponential one. Figure 3 shows a timeline how some technical innovations have settled in the society. As one can see, in late 19th century and early 20th century, it took many decades before the inventions were in mass usage. For example, it took 35 years for the telephone and 31 years for radio to break through and become a major success. In contrast, in the late 20th century, the technologies stabilized themselves much quicker than a century earlier. One should, however, note that the technologies described in the figure are quite traditional ones and do not present the industries in which we currently see the most potential, i.e. life-sciences and renewable energy.

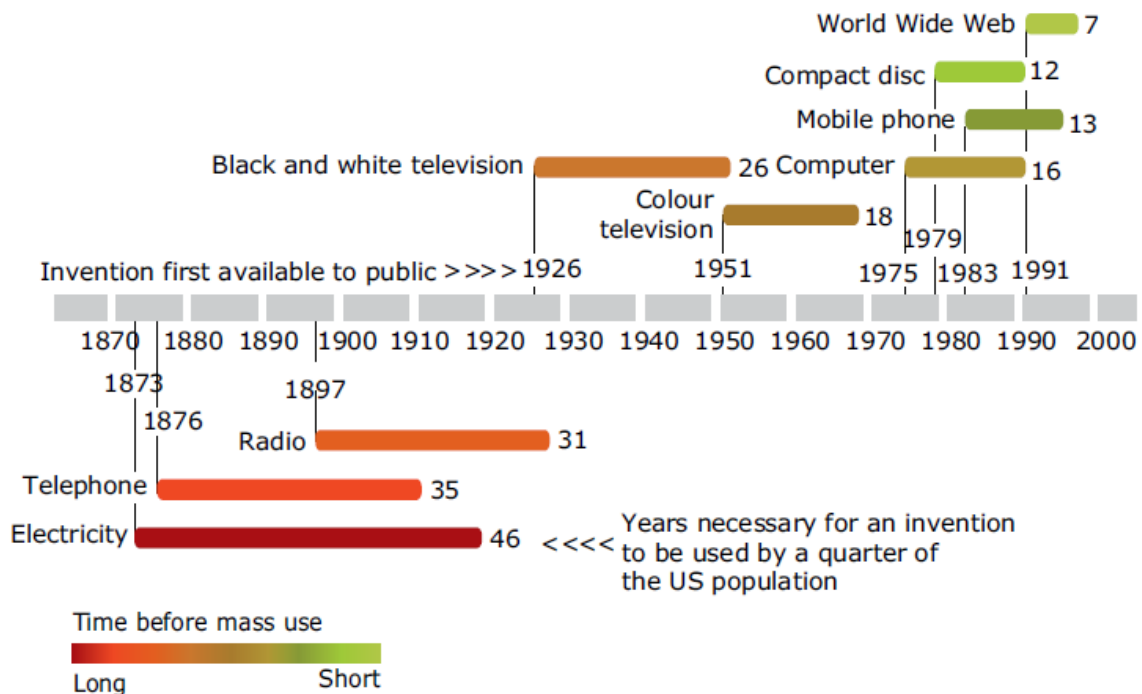


Figure 3 Time to adapt the innovations. Source (European Environment Agency, 2011)

The EEA report (2011) highlights that in sectors where the development has been very slow during the past decades, such as energy and transportation, the technological acceleration is likely to occur.

Another indication of the global speed-up is the change of the economic structure. Primary production was the main source of well being in Finland for over 2500 years. The next generation, the industrialism, emerged in the late 18th century and lasted for approximately 250 years. Ahvenainen et al. state that the 3rd generation, the ICT industry, was the main source of the wealth only for 25 years. If this trend is expected to continue, one could estimate the next “big thing” to remain only for 2.5 years. In the future, when the trends are even shorter, the core competence would be the ability to adapt to changes and manage the changes (Ahvenainen, Hietanen, & Huhtanen, 2009). This claim is supported by the fact that services are going to be more important in the global economy. Services are less capital intensive than industrial applications, thus reducing the amortization time of an investment. Investments are increasingly sifting from long-term to short-term investments.

2.3.5 Global megatrends

The difference between gigatrends and global megatrends might sometimes blurry and some phenomena could be grouped into both groups. Furthermore, the gigatrend concept is not as established as megatrend concept in the literature. Thereof, many articles and reports do not differentiate megatrends from gigatrends. In the following I am going to discuss the global megatrends based on a European Environmental Agency report (2011). The report categorizes megatrends to five different groups - social, technological, economic, environmental and political. The report doesn't differentiate gigatrends from megatrends, and thus both of these are depicted in Figure 4. As the gigatrends were discussed in the previous chapter, this chapter focuses solely on megatrends. Gigatrends are marked green in Figure 4.

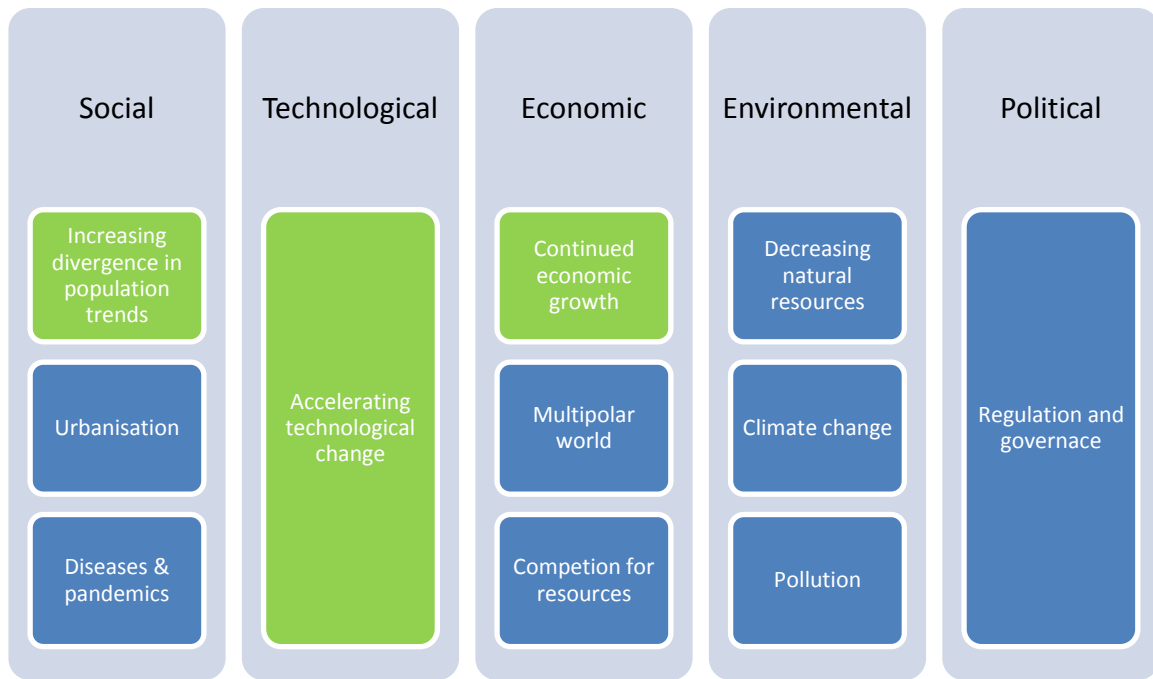


Figure 4 Global megatrends. Gigatrends differentiated from megatrends by green color. (European Environment Agency, 2011)

2.3.6 Social megatrends

Social megatrends – urbanization and diseases and pandemics – are discussed next. The issue of the increasing divergence in population trends was discussed in the previous chapter on gigatrends.

Urbanization

Nowadays over 50 % of the global population live in urban areas. The urbanization trend is assumed to continue, and by 2050, about 70 % of the population is expected to live in urban areas. The urbanization development has been very rapid as in 1950 only 30 % of the global population lived in cities. The percentages are not, however, good indicators of the urbanization level. One should also note that the world population has grown remarkable from the 1950s and will continue growing until 2050. Thus, population living in cities will be more than doubled between 1950 and 2050.

One reason for the popularity of the urban areas has been the possibility to improve the individual's living standards. Cities have traditionally provided people the opportunity to improve their wealth and quality of live. In the current state of the world, urbanization does not, however, automatically mean improved well-being for everybody. Urban poverty is rising and the number of people living in settlement houses is increasing. City infrastructures are challenged in megacities, where millions of people are packed in a small area. The infrastructure might not have been constructed at the same pace as the city population. This has caused – and will cause even more – problems for the urban

underprivileged. Poor urban living conditions combined with health and environmental risks could result in global pandemics with fatal consequences.

At a more general level, there are several matters accumulating and concentrating in the future, not only the population. Ahvenainen et al. (2009) recall concentration as a global megatrend with different kinds of outcomes on our society. The concentration is not only about population accumulation in megacities and urban areas but the phenomena affect the society in several layers. On one hand, the population will be more concentrated but on the other hand the population itself will be more heterogeneous. Within the city, wealth will be concentrated to fewer people whereas certain part of the population will face the poverty problems. There are likely to be both high-end suburbs and slums in future megacities. The development paths of the wealthiest and poorest quartiles will diverge, which would polarize the world. The polarization will happen within country borders, but also globally. Multipolarization of the world is further discussed in Chapter 2.3.7. (Nurmi, Vähätalo, & Saarimaa, Magneettiteknologiaklusteri 2020, 2011)

Diseases& Pandemics

In the globalized world people interact more with each other. Businesses will be run globally and markets will be global. The global interaction is not, however, limited to the business but people will interact more with each other as they are traveling in leisure. In the future, there will be millions of new middle class citizens, who can afford international travelling. Nowadays, the Chinese middle class is buying cars but within decades they be likely to spend their holidays by travelling abroad. Increased travelling is not only a result of increased wealth but also poverty. In the polarized world, where welfare differences are considerable, migration might be increased because people want to improve their welfare. Poor living conditions during the relocation are, however, very suitable for spreading diseases. (European Environment Agency, 2011)

Migration is a good breeding ground for disease spreading but on the global scale enlarged mobility could have even more dangerous outcomes. The ever increasing international interaction enables the diseases to become global pandemics. In addition, new pandemics and diseases could be resistant to currently used antibiotics. Due to the evolution and increased usage of medicines, diseases might be more fatal in the future.

2.3.7 Economic megatrends

In the previous chapters I discussed megatrends that might have severe social consequences in the future society. In the following, I will move the focus on economic matters. Continued economic

growth is discussed as a gigatrend in Chapter 2.3.2. Other megatrends that will have the most substantial effect on the world economics are discussed next. First I will discuss the megatrend of multipolarization and thereafter the intensified competition for the resources.

From a unipolar to a multipolar world

After the collapse of the USSR in 1991, there has been only one super power in global politics and business - USA produced 26 % of the world GDP in 2010. The US dominance is, however, expected to decrease in the future as the increasing share of the global GDP will be created in emerging and developing countries. As I discussed in Chapter 2.3.2, China and India will be engines of the world economics in the decades ahead. China's share of the global GDP was 7 % in 2010, but it is expected to grow to 17 % by 2050. India is also going to play a bigger part in the global GDP in the coming years. It is projected that India will produce 5.1 % of the global GDP in 2050, whereas it is now produces only 2.1 %. The hotspot of the world politics is likely to move alongside the economic focus to the emerging countries. It should be remembered that not only the economic growth but also the population growth will happen in emerging countries.

At the same time when emerging countries have increased their economic output, the world has become more interconnected, i.e. globalized. In the globalized world, companies' production depends on global supply chains and the products and services are sold in global markets. The multipolarization term is used to integrate new economic and political centers into the global business environment.

I regard that the multipolarization is a better term to describe the global business world than the term globalization. The multipolarization term represents the globally connected world but also highlights the importance of the local cultural aspects. Aaltonen and Jensen (2012) have stated that global actors interact between each other but the cultural differences are immense and they are not expected to vanish. In addition, rules, legislation and values are different in Scandinavia, Sahara and China. These issues have significant importance on the business environment. The multipolar world would highlight the global world yet respecting cultural differences.

In the multipolar world, the interaction between the different actors – nodes – will be increased. Connections between countries, regions, communities and people will be stronger than in the past. The connections between countries could be evaluated based on export amounts. Export patterns will suggest how the multipolar world will look like in the future. Export percentages of different countries are presented in Figure 5. The figure indicates that Sub-Saharan countries, China and

India will increase the most the export share in the future. US export is expected to remain almost constant during the same time period. (European Environment Agency, 2011)

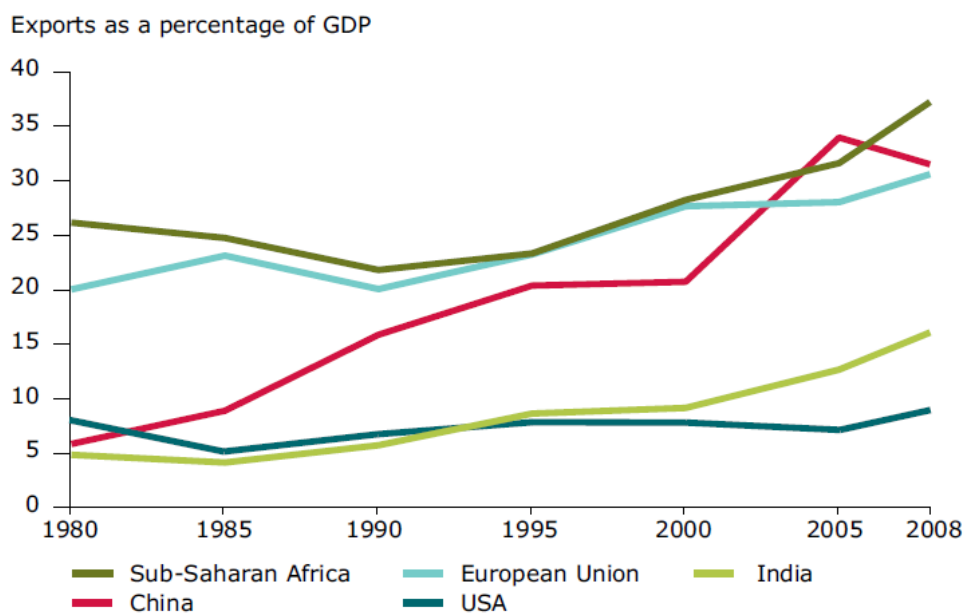


Figure 5 Export of GDP in different locations. Source (European Environment Agency, 2011)

The above figure shows the percentage figures of the exported goods out of the total GDP. The share is expected to expand the most in developing countries. In addition to percentage changes, the total export volumes are expected to change as well. The countries, which are expected to increase their shares in exports, are the same which are expected to increase the total GDP. Thus, their importance in the global business will be even greater than depicted in Figure 5. India, for example, raised its export/GDP ratio from 4.8 % to 13 % during three decades. At the same time, the average GDP growth in India has increased from 5.6 % to 6.4 %. The importance of the emerging countries is even greater than the export/GDP rate and economic growth rate predicts. One should remember that in 1980 20.5 % of the global GDP was exported whereas in 2007 the same figure was 27.1 %. This means that the economy is more global and more dependent on the production of the emerging countries. (European Environment Agency, 2011)

Intensified global competition for resources

Resources are needed to maintain and to accelerate the economic growth. In the future, there will be more players competing for the limited resources as discussed in the chapter on multipolarization. The current economic growth relies heavily on fossil fuels but in the future rare earth metals might be the key constraint of the economic growth. Rare earth metals, such as gallium, germanium and tantalum, are needed in many high-tech applications. The demand for these raw materials will be

increased but the supply is dominated by the decreasing reserves. The imbalance between supply and demand is not the only concern in the raw material supply. Many economically crucial reserves are concentrated to a small area. About 80 % of the coal reserves are located in six countries and correspondingly ten countries own 80 % of the global oil reserves.

The unevenly distributed resources combined with the increasing demand for fossil fuels could have wide-ranging consequences in the global economy and in the global politics in next decades. The rare earth metal reserves are also highly concentrated. Currently, rare earth metal reserves in China are remarkably higher than elsewhere. Furthermore, other important reserves are located in Brazil and Africa. Rare earth metal resources could be an essential enabler of the GDP growth in BRIC (Brazil, Russia, India and China) countries. Due to the strategic importance of reserves, countries might want to secure their raw material supply by limiting other countries' access to the reserves. (European Environment Agency, 2011)

Fossil fuels are expected to be the most important energy source until 2030 according to IEA study. Despite the increasing interest towards renewable energy, demand for fossil fuels is expected to grow during the next decades. Figure 6 shows the projections of energy usage in the next decades. To diminish the dependence on the fossil fuels, energy users need to pay attention to energy efficiency. According to Figure 6, energy efficiency would decrease especially the demand for coal.

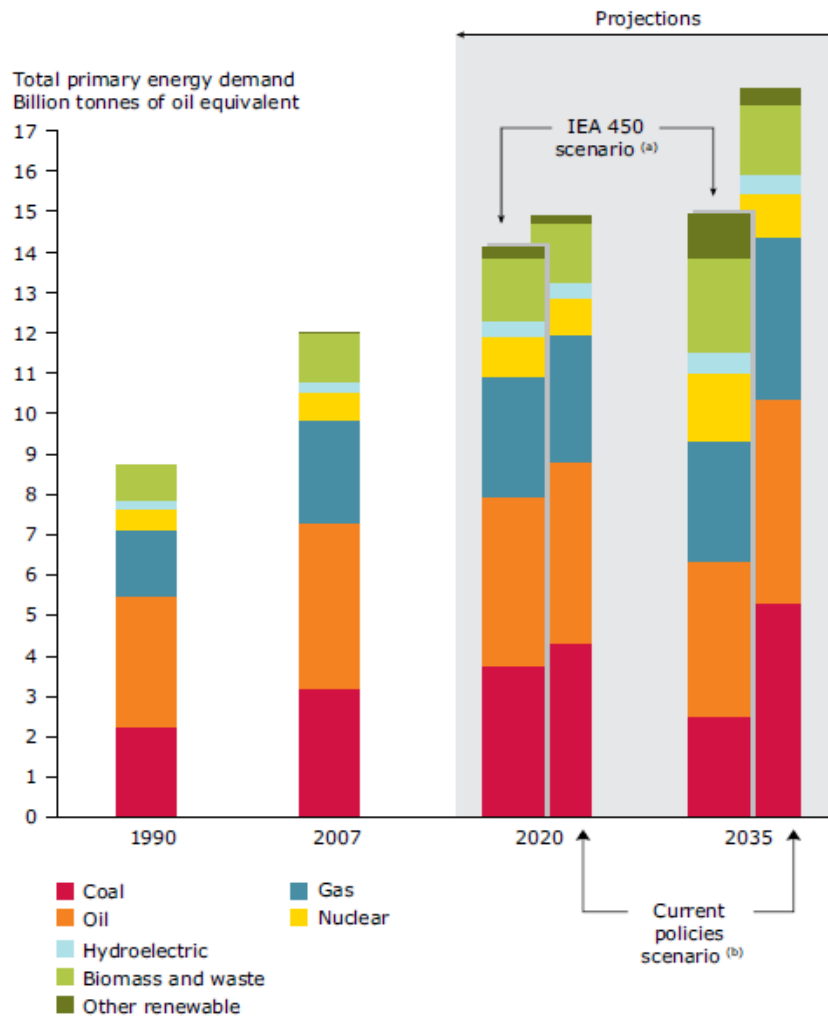


Figure 6 Total primary energy demand. Source (European Environment Agency, 2011)

Energy supply and demand will be a major issue in the future society. More energy is needed to boost the economic growth in emerging countries but at the same time energy usage should be reduced due to the environmental issues. Thus, the competition for the energy resources will be intensified due to the higher demand but also due to legislation limiting the access to energy resources. The usage of fossil fuels – coal, oil and gas – is especially influenced by the environmental aspects. Coal reserves are not scarce but due to the environmental aspects its usage should be avoided. Oil reserves are not going to be depleted but the cost of oil drilling will be higher than before. Despite the fact that the gas reserves are large and the environmental aspects of gas usage are lower compared with other fossil fuels, the gas has not become the most important energy source yet. Reasons for this could be logistical reasons and the fact that more than 50 % of the global gas reserves are found in four countries. (European Environment Agency, 2011)

2.3.8 Environmental

Above described megatrends are major challenges for the world's ecosystem. The interplay between above mentioned megatrends and the environmental aspects could be analyzed with the $I=PAT$ equation. This equation is used to describe how human actions affect the environment. Environmental impact (I) is the product of population (P), affluence (A) and technology (T). As described earlier the population and the overall affluence are going to increase in the future. In order to improve, or at least maintain, the current impact on environment the technology needs to proceed so that the increase in population and affluence could be compensated. However, the development of technology is unlikely going to be fast enough to restrain the environmental impact. Thus, the environmental awareness is regarded as one of the key megatrends in the following years.

EEA divides the environmental megatrends into three subcategories – declining stocks of natural resources, climate change and increasing pollution load. I will first discuss the decreasing stocks of natural resources. After that, climate change and increasing pollution load are discussed together.

Decreasing stocks of natural resources

As described earlier, known energy resources are going to decrease in the future which will have dramatic consequences in global politics and economy. In addition, the demand for rare earth metals is going to accelerate fast when new technologies are introduced. The energy and raw material issues are only one side of the scarcity issue and it could be that some of these issues have only an indirect effect on the people. For example, if the price of gallium increases due to the scarcity, you might reconsider your solar panel investment but your life will be unchanged. However, the lack of food is more crucial to the every-day life. It is projected that by the year 2050 the demand for agricultural products would increase by 50 %. In order to respond to this demand, the agricultural area should be increased by 10 % with the current rate of productivity improvements.

Unsustainable methods to increase the agricultural productions could, however, jeopardize the productivity. As agriculture has overtaken forest areas in many locations, deforestation and biodiversity loss have become major concerns of the environmental organizations. Deforestation is negative in terms of climate change and biodiversity loss could have unpredictable outcomes to the entire global ecosystem. On the other hand, agriculture based on few species and heavy fertilization would lead to soil degradation. This would have a negative effect on the production capacity of the earth. (European Environment Agency, 2011)

Increasingly severe consequences of climate change and pollution load

The global average temperature has risen 0.7-0.8 °C by 2009 compared with the preindustrial era. The temperature is also expected to rise in this century, and alarmingly it is expected to rise more than before. Some predictions suggest that the global temperature might rise by 1.8-4.0 °C by the end of the century. A temperature rise of 1-4 degrees would have severe outcomes to the earth and its ecosystems. One should remember that Earth's resources are already 1.5 times overused – climate change combined with increasing population is not a sustainable equation. To improve the sustainable development, the western society is currently paying attention to the greenhouse gas emissions. The reduction of greenhouse gas emissions is essential in the attempt to slow down the temperature rise.

The climate change has various outcomes to the global environment. Just to mention a few, crop production is projected to decrease in the long run and the water availability might be threatened. Due to the climate change, dry areas on the earth will become even drier and the extreme weather conditions will become more frequent and intensified. Like I have described earlier, the differences between preferred and unpreferred locations on the earth will become bigger. This is partly due to the climate change. What is the implication to Finland? According to the Climate Guide (Finnish Environment Institute, Aalto University, Finnish Meteorological Institute), the climate change might have positive effects on the Finnish economy, especially in the agriculture and forest industry, but due to the international business negative effects in other locations will be transmitted to Finland. Climate Guide also highlights that the buildings and the infrastructure are going to be stressed more in the future. Increased precipitation, heavy winds and the shorter cold weather periods are challenging for the buildings but also for the roads. (Finnish Environment Institute, Aalto University, Finnish Meteorological Institute)

In addition to the climate change, the pollution load is a problem which needs to be solved in the future. Currently, the fine particles cause 500 000 premature deaths a year in Europe (European Environment Agency, 2011). Increased air pollution is one outcome of the increased pollution load but ocean and land pollution loads are also expected to increase due to the augmented usage of fertilizers and chemicals. Soil pollution is likely to have many local consequences but the increased air and water pollution is a global problem. A good example to illustrate the global nature of the pollution load problem is the increasing ozone hole. Pollutants emitted around the world increase the ozone hole and thus change the living conditions on the earth. Your climate will be changed whether you have emitted the chlorofluorocarbons or not. As the climate change and increasing

pollution load are global problems, there is likely to be more regulation, both international and national, to decrease the climate change. Traffic and energy legislation is already tightening in European Union to tackle the climate change and the pollution load issues. The cost of governments' purposes to limit the external effects will eventually be paid by the industry and consumers. Industry's costs will be increased but at the same time legislation changes provide new business opportunities.

2.3.9 Political

In the previous chapters I have discussed social, technological, economic and environmental megatrends. In the following, I am going to focus on political megatrends.

In the global economy where individuals, companies and nations are interconnected and where the outcomes of the climate change and pollution are global, global decision making, regulation and governance are needed. This is not an easy task. In the multipolar world, complicated interconnections between regions and totally different ambitions will make it extremely difficult to find the political consensus. According to Ahvanainen et al. (2009), different ethnical and economic drivers make it difficult to find solutions that would benefit the common wealth. They also state that the decision making in organs, such as EU and NATO, will be more difficult in the future. This is easy to believe, because currently the powerful G8 group, consist of western countries which share approximately the same cultural identity and economic phase. As new countries join the group the heterogeneity of the group increases remarkable, which definitely challenges the decision making processes.

The trend that the legislation and governance extend beyond the international treaty regimes and organizations is also highlighted in the EEA's megatrend report (European Environment Agency, 2011). The study identifies four aspects which are likely to affect the global regulation and governance procedures. Firstly, the cooperation and integration between regions are expected to increase. Secondly, the groupings of leading countries, like G8 or G20, are more important in the future. Countries are going to deepen their cooperation with countries that are the most important to their politics and economy. This is especially expected to happen in East Asia. Thirdly, the policy coordination is going to have new and softer forms in the future. This means that there will be more guidelines and frameworks instead of laws. Despite the fragmentation of the legislative tools, the standards and the integrity in legislation are going to increase. The principles of good governance are likely to be aligned in different countries. In addition, there are going to be severe organizations which are allowed to participate in the governance process. Related to this, EEA defines the emerge

of the public-private governance as the fourth trend in the politics. Non-governmental organizations (NGO) and international enterprises are expected to gain influence in the governance procedures. This might be seen as an increase in the private-public but also private-private partnerships which are supposed to define the operation framework. (European Environment Agency, 2011)

2.4 Transportation industry specific megatrends

In the previous chapters I have discussed global megatrends. These trends are expected to have a major effect on our society in the next decades. Megatrends will shape the future business framework by providing new business potential for certain industries but also by shriving some businesses. To estimate the Finnish shipping requirements in 2025, it is important to analyze the business framework in 2025 but also the drivers that will influence the transportation industry development. In the following I am going to review megatrends that will affect how Finnish industry products are shipped abroad.

World Energy Council has identified drivers which will affect the transportation development until 2050 (World Energy Council, 2011). These drivers can be regarded as transportation industry specific megatrends. They identify

- economic growth,
- demographic trends,
- urbanization and megacities,
- geopolitics,
- global oil reserve and supply,
- environmental and health concerns,
- policies and regulations,
- lifestyle changes,
- alternative fuels,
- fuel efficiencies and
- innovations

as the key drivers which are going to shape the future transportation requirements. Some of these drivers, like economic growth, demographic trends, urbanization and megacities, are general megatrends that will not only affect the transportation industry but also other industries and the overall society. Compared to general megatrends, energy related issues have higher importance in the transportation industry due to the transportation energy intensiveness. World Energy Council's

study describes three energy related topics, i.e. oil reserves, alternative fuels and fuel efficiency as factors that are likely to influence the future of transportations. It cannot be denied that energy would be not important in the transportation industry, but one should also note that the study was conducted by the World Energy Council. Hence, the energy related topics might be overplayed in the study. Nevertheless, DNV has also highlighted the energy issues as one crucial topic in the sea transportation (Det Norske Veritas, 2012).

If the energy efficiency and alternative fuels are important aspects in the fleet operation, transportation industry should also pay attention to the infrastructure. The infrastructure development will have a strategic influence on the whole transportation industry. Schuckmann et al. have analyzed factors which would influence the transportation infrastructure development until 2030. In the research, which was based on the Delphi method, they have analyzed the expected probability of occurrence, impact and desirability of 15 different assumptions with help of the expert panel. Assumptions are presented in Table 2. (Schuckmann, Gnatzy, Darkow, & von der Gracht, 2012)

Table 2 Statements of transportation infrastructure. Modified from (Schuckmann, Gnatzy, Darkow, & von der Gracht, 2012)

No	Projections for the future of transport infrastructure 2030
1	There is no longer a shortage of transport infrastructure since sufficient investments have been made.
2	Transport infrastructure development strongly focuses on urban areas, while rural areas are neglected.
3	Infrastructure shortages (e.g. insufficient transport infrastructure) have forced the division of megacities into decentralized, autonomous “sub-cities”.
4	In emerging countries, there is more capital available to invest in transport infrastructure than in industrialized countries.
5	Financing the maintenance of transport infrastructure is more difficult than attracting investments in new infrastructure.
6	Financial pressure on governments has become so intense that almost all investment in transport infrastructure has been shifted to the private sector.
7	Governments are no longer able to contribute to the funding of local transport infrastructure (e.g. main roads and subways), thus user-based financing structures are prevalent.
8	International transport infrastructure (e.g. major ports and airports) is controlled by private investment funds, which are strategic drivers of large-scale transport infrastructure projects.
9	Strong regulatory measures, such as road tolls and congestion charges, compensate for the increased need to invest in transport infrastructure.
10	Transport infrastructure is still a key element of the basic services of an economy, but is no longer a deciding factor in the competition between countries to attract investment.
11	Industrialized countries have lost their competitive advantage over emerging countries in terms of transport infrastructure.
12	Digital infrastructure (ICT) has become a stronger driver of economic growth than transport infrastructure.
13	A decrease in environmental awareness and regulation has accelerated the realization of large-scale transport infrastructure projects, boosting economic growth.
14	Transport infrastructure operators are obliged to participate in emission trading systems to obtain pollution permits.
15	The environmental costs caused by infrastructure development (including emissions resulting from

construction) have become a serious deterrent to investments for which there is otherwise a good economic case.

Like mentioned Schuckmann et al. analyzed the expected probability, impact and desirability of each assumption. Impact and desirability of each assumption (numbers 1-15 in Table 2) were assessed in 5-point-likert scale, where 5 indicated the most preferred outcome and 1 the worst scenario. The probability of occurrence was presented as percentage. Results are shown in figure below.

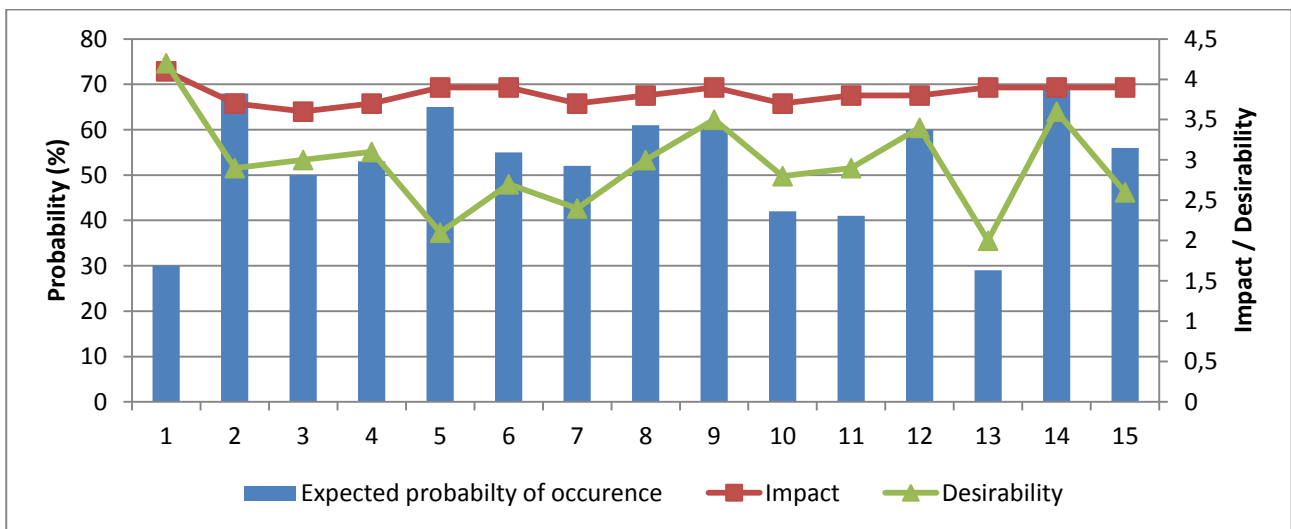


Figure 7 Expected probability, impact and desirability of different statements. Numbers in x-axis refer to Table 2. (Schuckmann, Gnatzy, Darkow, & von der Gracht, 2012)

According to the expert panel, the claim “Transport infrastructure operators are obliged to participate in emission trading systems to obtain pollution permits” is the most likely to be realized in the future. Other claims that were ranked high in terms of occurrence probabilities are “Transport infrastructure development strongly focuses on urban areas, while rural areas are neglected” and “Financing the maintenance of transport infrastructure is more difficult than attracting investments in new infrastructure”. The expected probabilities of these statements are 65 % and 69 % respectively. These claims correlate highly with the ecological awareness megatrend and urbanization megatrend. Other megatrends which could be spotted from the results are globalization and the change of legislative environment. The public-private partnership is expected to be a more common method to finance the infrastructure investments in the next decades. Financing of the infrastructure projects will be more difficult according to the study.

A very interesting point of the transportation industry development was introduced by Ahvenainen et al. (2009). They suggest that the global transportation channels will be transformed to production

channels. In the current economy, costs are minimized by producing products in the cheapest location and transporting products to consumers. Due to the low cost of transportation companies have maximized profits by maximizing the transportation distances and minimizing the production costs. In addition, the current industrial engineering trend has focused on the removal of the stocks, which have increased transportations. In the future this might no more be the most cost efficient way to operate. Environmental legislation could increase the transportation costs which might lead to different transportation strategies. In the world where both stocks and transportation are expensive, the most cost efficient way would be to combine the production and transportation to a certain degree. In the future transportation would not only be transportation but the transported product could be processed meanwhile.

Although production and transportation is expected to merge in the future, it is hard to believe that vessels already in 2025 would have the production capacity integrated. The change will take more time and the integration process will most likely be stepwise. There might be already some “integrated manufacturing functions” onboard but the still the vessels are mainly used to transport products. So far the transportation capacity issue is analyzed from the megatrend point of view. To maintain a more comprehensive view of future transportation requirements, the demand for transportation services i.e. the development of the Finnish industry is reviewed next.

3 INDUSTRY TRENDS

Megatrends are global phenomena which have an effect on human and technology development. The influence will be different in different locations but also within different industries. In the next chapters, megatrends are discussed in the industry framework in order to build more specific outlook of future states. Outlooks for the industry developments are derived from the megatrend analysis. Additionally, the industry development is reviewed according to industries' own perceptions of the future. At the beginning of the chapter, Finnish export and import are reviewed to choose the industries to be further analyzed.

3.1 Selected industries

According to the Finnish Customs, the Finnish export consisted mainly of metal, machine and vehicle industry products in 2011. They accounted for 33.5 % of the total Finnish export in 2011. The second most important exporter was the chemical industry with a share of 21.7 %. The third biggest exporter was the pulp and paper industry. Almost 20 % of the total export was pulp and paper products. Electrical appliances counted for 13.4 % of the total export. The structure of the Finnish export in 2011 is shown in Figure 8. (Finnish Customs, 2012)

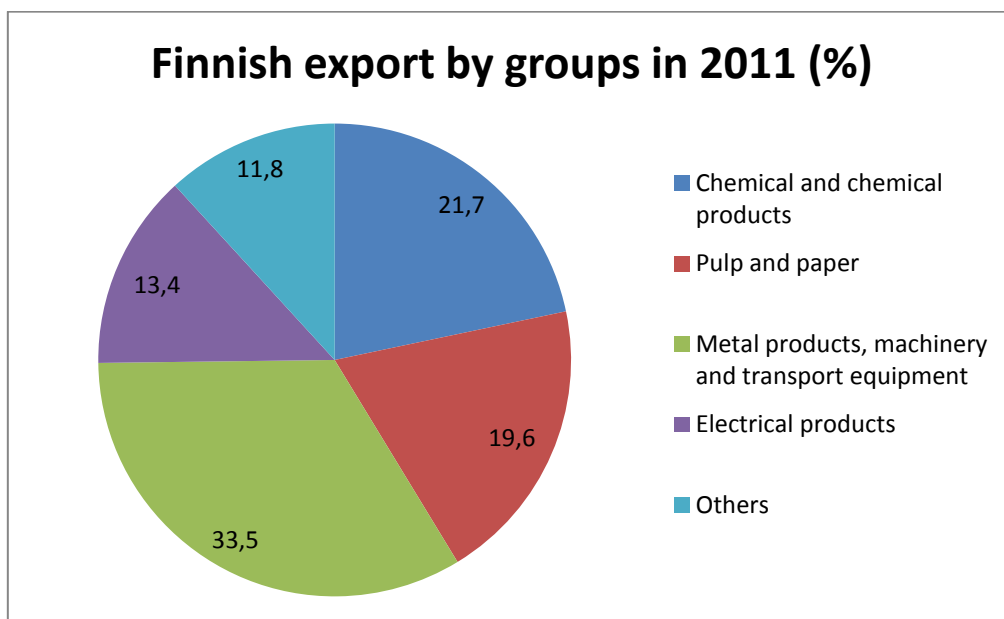


Figure 8 Finnish export in 2011 (Finnish Customs, 2012)

In the Finnish import, raw materials, intermediate goods and energy are the most important categories. Intermediate goods equal to 34.6 % of the total import whereas the energy import accounted for 21.8 % of the import. Almost one fifth of the Finnish import is capital goods. The

share of the consumer goods in approximately 24 %. The Finnish import in 2011 is shown in Figure 9. (Finnish Customs, 2012)

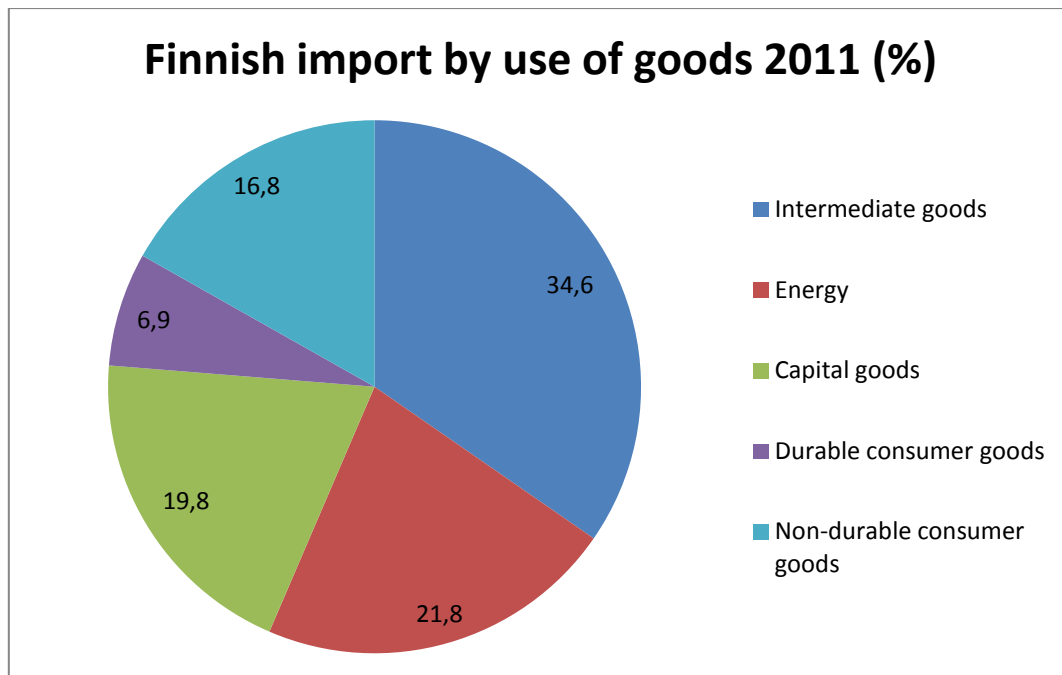


Figure 9 Finnish imports by use of goods in 2011 (Finnish Customs, 2012)

In the thesis, I am going to focus on the industries that are currently the most important exporters. The focus is selected for two reasons. Firstly, the export industry is crucial to Finnish economy. 2011 the value of the export was 30 % of the total GDP. Secondly, import is very dependent on the development of the export industry. Over a half of the import is either intermediate goods or energy. If the export stalled, the import would also be decreased. As classifications in Figure 8 and Figure 9 are very general, I have divided certain segments into more specific ones. The group of “metal products, machinery and transportation equipment” is for example split to mining and metals industry and to technology industry.

The industry analysis has four parts. First of all, the industry overview is represented. After the industry facts are known, industry trends are reviewed. Industry trends are mainly based on the industry’s own visions and estimates of the development. Thirdly, the possible industry development is analyzed in the megatrend framework. Lastly, industry analysis is summarized to a few possible statements about the future.

3.2 Metal and Mining

3.2.1 Industry overview

By Metal and mining industry is meant a group of companies which extract, process or refine minerals, metals and other materials. Metal and mining industry has been a hot topic not only in economy but also in politics during the last few years. Metal extraction has been financially feasible during the past years due to the increased demand but at the same time increased mining has led to negative environmental and social external effects. The Finnish government is looking forward to metals and mining industry to become a major industry in Finland. The government has stated in the current government program that it will support the growth and development of the mining and mineral cluster (Aaltonen, et al., 2012).

Metal and mining could be divided into the extraction, processing and refinement of the raw material. Furthermore, there are several companies in Finland that provide services and supportive products for the metal and mining industry. Extraction and refining subsectors are discussed in the thesis context because they need the most transportation capacity. The processing industry is excluded from the analysis in this chapter because it is partly discussed in the technology industry section.

Due to the increased demand for the metals and rare earth metals, there have been heavy investments in the mining industry during the past years. According to preliminary estimates, there might investments in the Finnish metal and mining industry worth 4 billion Euros in the 2010s (Aaltonen, et al., 2012). One should, however, remember that the prolonged recession is likely to cut the investments. Currently there are 12 metal ores and 31 mines for industrial metal mining in operation in Finland. In addition to these, there are several mines and workings for mineral mining. Figure 10 shows ores and mines in Finland in 2011.

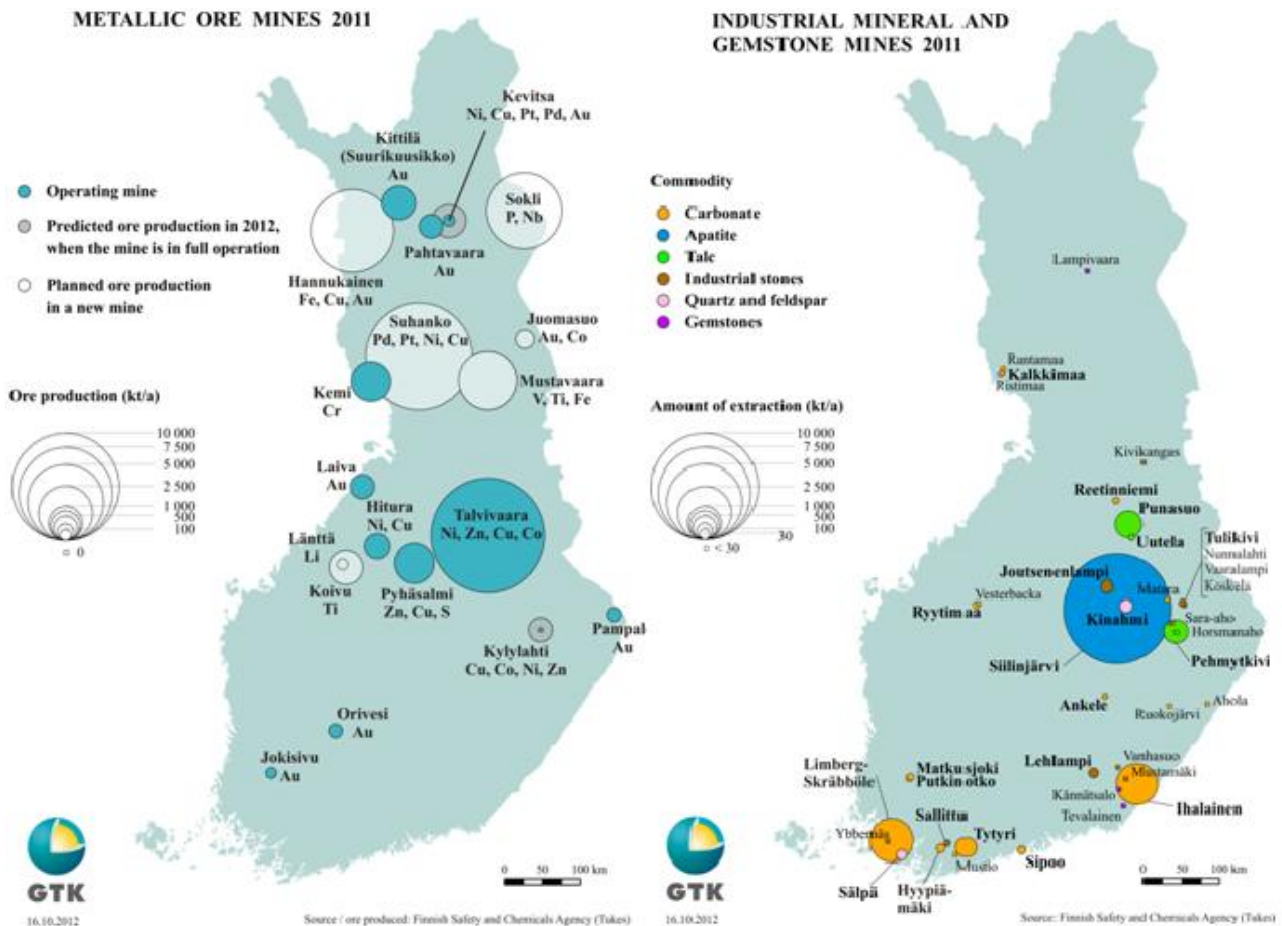


Figure 10 Metallic ores and industrial mineral and gemstone mines in Finland 2011 (Ministry of Finnish employment and the Economy, 2012)

As we can see from Figure 10, the metallic ore mines are mainly in the northern part of Finland whereas the industrial mineral and gemstone mines are either on the east side of Finland or on the southern coast. According to the Finnish Ministry of employment and education (Aaltonen, et al., 2012) iron, chromium, titanium, zinc and manganese are the five most common metals in the Finnish soil. If the value of the reserves is calculated in Euros, the most important metals are nickel and chromium. The book values of these reserves are approximately 80 000 and 60 000 million Euros respectively. The third most important metal in monetary measures is copper, the value of which is approximately 20 000 million Euros. The total turnover of the mining industry was 1.48 billion Euros in 2011. The metal mining industry generated 65 % of the industry turnover. (Uusisuo, 2012)

Despite there are metals worth billions of Euros in the Finnish ground, processing metals from ores to intermediate products is not an easy task. Ores are not pure but they contain many different elements. Some of these elements are valuable whereas the other are just left-over rock. In general, several steps are needed in order to produce high quality raw materials that are suitable for

industrial usage (Metso Oy, 2007). Table 3 shows the produced amounts of refined materials and concentrate production in Finland.

Table 3 Production of refinements in Finland (Uusisuo, 2012)

2011	Concentrate production tonnes	Refining of concentrates tonnes	Production from refining %
Iron ore concentrate		3 608 222	0
Chromium concentrate	692 527	689 435	100.4
Copper concentrate	48 668	464 033	10.5
Nickel concentrate	91 196	344 677	26.5
Cobalt concentrate		8 994	
Zinc concentrate	87 974	582 323	15.1

As we can see from the table, there is more chromium mined in Finland than refined. Copper, nickel and zinc are however imported to Finland to be refined.

3.2.2 Industry trends

Due to the increased demand for metals, there are several plans for mining industry investments in Finland. According to Aaltonen et. al (2012) there are currently 10-15 significant investments planned for the industry. If these investments are realized, the most of them will take place between 2013 and 2017. Together all the planned investments are worth over 4 billion Euros. However, due to the slowdown of the global economic growth the prices for the metals have sunk. This has caused many companies to freeze their investments. In general, the demand for the metals is closely linked to the global economic growth. The highest demand for the metals is expected to take place in emerging countries because their economic growth will be the fastest but also due to the fact that industrialized countries are moving towards the post-industrialized era.

Like it was mentioned in the megatrend chapter, the world is going to “speed-up”. This acceleration can also be seen as a global trend in the metal and mining industry. Uusisuo (2012) states that the predictability of mining investments will be decreased in the future. Reasons for greater uncertainty are mainly caused by the increased political risks, taxes and fluctuations in prices and mining costs. PricewaterhouseCoopers also defines the increased volatility as one of the key trends in the metal and mining industry (PwC, 2012). Despite the increased uncertainty, Uusisuo has presented a graph which shows the projected metal mining volumes in the next years.

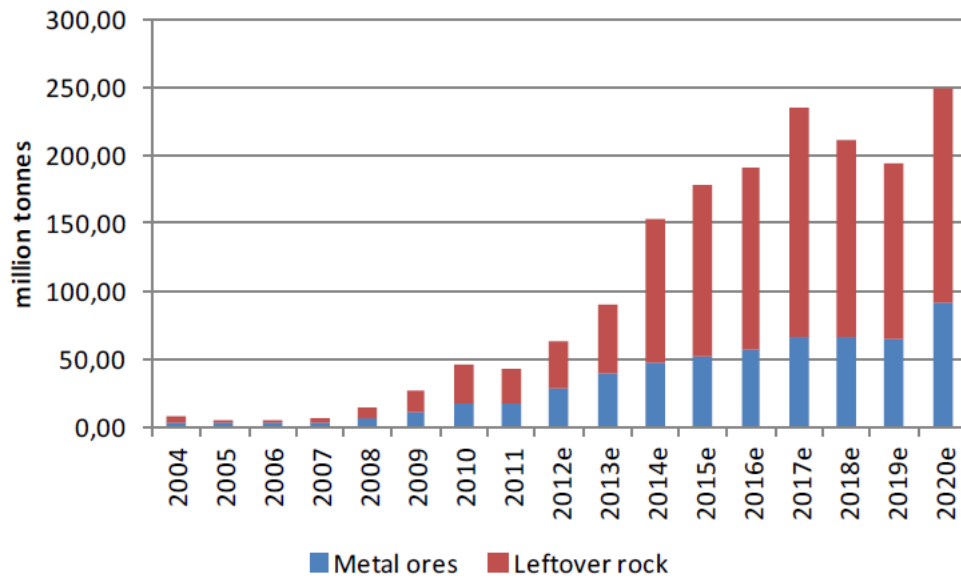


Figure 11 Estimate of metal ore mining (Uusisuo, 2012)

As we can see from Figure 11, Uusisuo estimates that the metal ore mining is going to be approximately 2-times higher in 2020 than in 2012. The same figure shows also that the more ore will be mined, the more leftover rock is produced. This is due to the dilatation of the deposits. As the leftover rock amount per ore volume increase, the costs of the mining increase as well. Dilatation could be one reason for the increased volatility in the metal and mining sector. In addition to this, new deposits are found more rarely. Thus, it seems that the demand for metals and minerals will be high in the future, but the metals and mining industry is facing problems with the supply (PwC, 2012).

3.2.3 Megatrend analysis

In the following, I am going to analyze the Finnish metal and mining industry development in the megatrend framework. Figure 12 shows how the megatrends might affect the Finnish metal and mining industry in the coming years. In figure each megatrend has its own axis. The effect of the megatrends could be either positive (1), neutral (0) or negative (-1). The points which are outside the red circle indicate the positive effect and points which are inside the red circle negative effects. Neutral effect is marked with a point in the red circle.

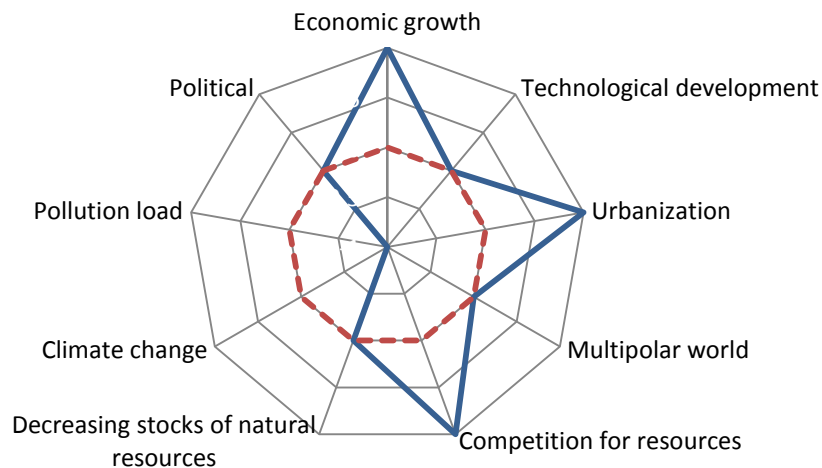


Figure 12 Metals and mining industry in megatrend framework

Economic growth

I have marked that the economic growth and urbanization would have positive an effect on the industry. Despite the increased weight of services in the global economy, raw materials and metals are still needed in a future society. In fact, the demand for certain metals might be skyrocket due to the increasing middle class consumption. Many middle class luxury items, such as cars, require large amount of steel and iron ore. In case there would be a technology leap, which some futurists forecast, and the emerging countries would skip the industrial era and move directly to the post-industrialized era, the metals would still be needed (Wilenius & Kurki, 2012). The demand for iron and other early cycle commodities would be lower but the demand for late and middle cycle commodities would be increased. Figure 12 shows how the GDP is related to the metal demand. As we can notice, the higher the GDP the higher is the demand for late cycle commodities, such as platinum and nickel. Low GDP countries demand more for steel and iron (i.e. early cycle metals) but the demand for these metals decrease after a certain GDP point.

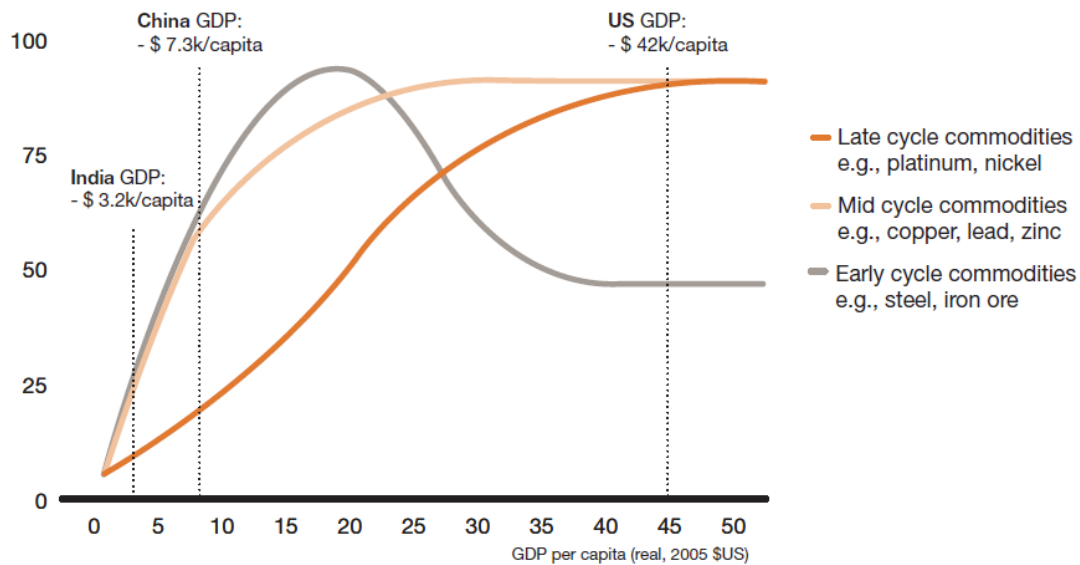


Figure 13 Commodity intensity. Indexed at 100 for maximum. (PwC, 2012)

The Finnish metal and mining industry might benefit from the increased demand for the middle and late cycle metals. Like discussed earlier, Finnish ground contain mainly these metals. Another issue that could improve the competitive advantage of the Finnish metal and mining industry is the increased volatility. Politically stable locations, such as Finland, and good infrastructure might attract new mining investments in Finland.

However, there are also risks involved in the industry development. As the demand for metals and minerals will come from developing countries in the future, supply of these raw materials might also move to these countries. Especially if the transportation costs will be increased, currently non-profitable mines might turn valuable. In addition, the increased recycling could reduce the demand for extraction. Furthermore, different legislation around the world might twist the mineral markets. Due to the local political and environmental legislation, it might be much easier and more cost-efficient to mine the metals near the consumption. One should also remember that the higher the demand, the more mines will be profitable. The market patterns might thus be radically changed in the future.

Technical development

I assume that the technical development has neutral effect on the Finnish metal and mining industry. I base my claim of the fact that technology development would have both positive and negative effects on the industry. On one hand new technologies require different metals as their raw material. For example, the demand for silicon has increased rapidly during the ICT era. In the future, there might be new raw materials that are essential for the new technology. On the other hand, the

technology development does also have negative influence on the metal and mining industry. Due to the improved technology, less metal is needed to produce the same utility. In addition, environmental aspects are pushing the industries towards closed cycles, in which the raw material would be recycled. Thus, the increased demand for metals might be partly supplied by the recycled materials.

It has also been highlighted in the thesis that the economic growth will happen in emerging countries in the future. Technical knowhow will also be improved in these countries. Thus, if the emerging countries have the resources and knowhow to refinement, why should they not take the advantage of the home markets? Other drivers to move the metal and mining industry to emerging countries are the increasing environmental legislation and post-industrialism in western countries. These drivers might have a negative effect on the transportation volumes in Finland.

Multipolarization

The multipolar world has a neutral effect on the metal and mining industry. The positive sides are associated with the increased competition for the resources and the limited supply. The more competition there will be for resources, the more efficiently markets will operate. The multipolarization of the world would definitely increase the competition for the metal and mining sector products. In addition, the increased demand has a positive effect on the commodity prices. It should also be remembered that the supply of the metals and minerals cannot be increased unlimited. According to PwC (2012) the metal and mining industry has been struggling bringing the supply to markets. Reasons for this have been, for example, the dilution of existing mines but also the remoteness of new mines. Despite increased amount of closed cycle methods, the supply problems are not expected to vanish in the near future. Thus, it can be stated that the increased mining costs will be compensated with the higher commodity prices. Existing mines in have good changes to succeed.

If the Finnish industry has good changes to succeed, why the multipolarization is expected to have neutral effect on the industry developments? One essential reason to support the claim is the political aspect of metal and mining sector. Like we have noticed in the Finnish society, mine investments are not done according to the financial basis but also on political ones. If two investments are financially equally profitable, the decision could be made according to investment's external effects. If the domestic policy making influence the mining investments, it is easy to believe that global politics will have a tremendous effect on metal and mining industry. Trade restrictions to promote the domestic industry or to secure the supply of raw material could affect the metal and

mining industry more in the future (PwC, 2012). At the Finnish point of view, this could limit the markets for refinements but also set challenges to the supply of the raw materials. As it was stated earlier, the majority of refinement raw materials are imported to Finland. Thus, it might more difficult to get raw materials abroad.

I discussed in the megatrend chapter that multipolarization could also result in a stronger cooperation between similar countries. Nordic cooperation in the metal and mining industry might be increased to improve the Nordic operative conditions but also to increase power in the multipolar world. Energy intensive metal and mining sector could benefit from common electricity markets but also from the close resources. According to GTK, SGU and NGU there are a lot of resources in the northern Nordic. It should be considered whether by integrating the procession and transportation of these resources is financially feasible. (NGU, 2011), (Geological Survey of Sweden)

Environmental

Metal and mining industry is very energy intensive. Especially, the grinding and material handling are extremely energy intensive. According to an U.S. study, the U.S. mining industry used 1246 trillion Btu energy yearly. Most of this energy was generated by diesel (34 %) or was electrical energy (32 %). Coal and natural gas were also important energy sources for U.S. mining industry (10 % and 22 % respectively). (U.S. Department of Energy, 2007)

Not only are industry costs increased due to the high dependence on the fossil fuels but there are also other energy-efficiency requirements that will challenge the metal and mining industry in the future. Especially, in industrialized countries, where the environmental legislation is strict, the costs of production might increase remarkably. It is also possible, that the production will be shifted to countries that do not have as strict legislation as the western countries.

The awareness of the pollution load has also negative effect on the metal and mining industry. The metal refinement is a chemical intensive process. The industry practices have improved during the last decades but there is still a risk for chemical leakages. People in western countries are currently more aware of the risk and thus it might more difficult for the companies to gain the “license to operate.”

Political

According to the megatrend review, the political environment is going to be more diversified in the future. The political framework is not any more set by the government but there are NGOs and

groupings of countries which could affect the decisions. The rise of the NGOs is likely to complicate the process how the companies get the “license to operate” but on the other hand, the increased public-private co-operation might improve the metal and mining development. One possible trend could be that coalitions, which would correspond to the OPEC coalition, would emerge also in the mining sector. In general, the nature of oil drilling and mining is very similar.

Due to the increased heterogeneity in the political decision making and the increased volatility in the metal and mineral markets, the stability of the Finnish society might prove valuable to future’s metal and mining sector. Currently planned investments and the strong political support provide a good starting point for the industry development but in order to succeed economic excellence is needed. One should, however, note that before 2025 there will be three new governments in Finland, so the political environment could change many times before 2025.

3.2.4 Industry summary and shipping requirements

Based on the previous analysis, I have formed statements to forecast the Finnish metal and mining industry development.

Statement 1: Export of the late and middle cycle refined metals and minerals are expected to increase whereas the import of raw material will be substituted with domestic production. The volatility of the metal and mineral markets will be increased. Energy supply, energy efficiency and political atmosphere set the framework for the forecast.

Statement 2: There will be closer operation between countries and areas or even production coalitions in the metal and mining industry, for example in the northern parts of Nordic countries. On the other hand, the multipolarization of the world might increase the importance of local resources.

Metal and mineral sector is likely to augment the export the most in the next decades compared to other industry sectors. The increased export volumes might not, however, directly increase the seaborne transportations in the Baltic Sea because of alternative transportation routes. Environmental legislation might shift the transportation to Norwegian coast, outside the SECA area. Another issue that ship operators should be aware of the metal and mining industry is the increased volatility in the transportation volumes. Changes in commodity prices will influence the mining profitability and mines could be closed or reopened more frequently. Thus, from the metals and minerals point of view, the future shipping capacity should be both cost-efficient and agile.

3.3 Chemical industry

3.3.1 Industry overview

Chemical industry accounted for 23 % of the Finnish export in 2011. The total value of the chemical industry's export was 12 billion Euros in 2011. There are two main components in the chemical sector, basic chemicals and oil products, which were 72 % of the export (Chemical Industry Federation of Finland, 2012). Other important products were medicines (10 % of chemical export), plastics (7 % of chemical export) and rubber products (4 % of chemical export). In addition to the above mentioned segments, chemical industry exports paints, lacquers, detergents and cosmetics. The industry imports worth 11.2 billion Euros in 2011. Oil products are the most important import group followed by the basic chemicals. The respective shares are 31 % and 28 % of the total import value.

The majority of the chemical production is supplied as intermediate goods for other industries. Especially the forest industry has been a big buyer of the chemical products but also construction and electronics industries consume lots of chemicals. Forest companies have owned chemical companies in the past but they have liquidated their ownership during the last decades. There have also been other changes in the ownership of the Finnish chemical industry as the Finnish government has listed the companies to stock exchange and sold its ownership in chemical companies.

There have also been other changes in the chemical industry during the last decades. The usage of packing and construction plastics has increased which have had a positive effect on the chemical industry. Despite the growth in packing and construction plastics, the largest growth has taken place in the electrical industry chemicals. The chemical requirements of the electrical industry are now 100 times larger than two decades ago. During the last few years, bioeconomy has become part of the chemical industry. In addition to these changes, the chemical industry has become more global and increased the cooperation with the customers. (Meristö & Kettunen, 2007)

3.3.2 Industry trends

The Finnish chemical industry has conducted a study that forecasts the industry development in the coming years (Meristö & Kettunen, 2007). As there are several scenarios forecasted in the study I shortly discuss the study before analyzing the industry in terms of megatrends.

Meristö and Kettunen surveyed several chemical industry actors about their beliefs of the current and the future chemical industry. The results are shown in Figure 14. The biggest gaps between current state and future state are assumed to be in the focus of the chemical industry. According to

the study, the environmental friendly chemistry and broader focus of the industry are expected to happen. The study also highlights the importance of the global powers steering the industry instead of domestic markets. I find the most important issues of the study the 3rd last question. Study suggests that the chemical industry in 2021 will deliver cluster services to clients instead of focusing on certain industry branches. Like discussed in the megatrend chapter, the technological convergence will merge different technologies together. The bioeconomy will be dependent on the chemical industry, but there are likely to be different applications where chemistry could be mixed with other technologies to fulfill the customer needs. As the markets are global and diverse, the niche market will be large enough for many companies. (Meristö & Kettunen, 2007)

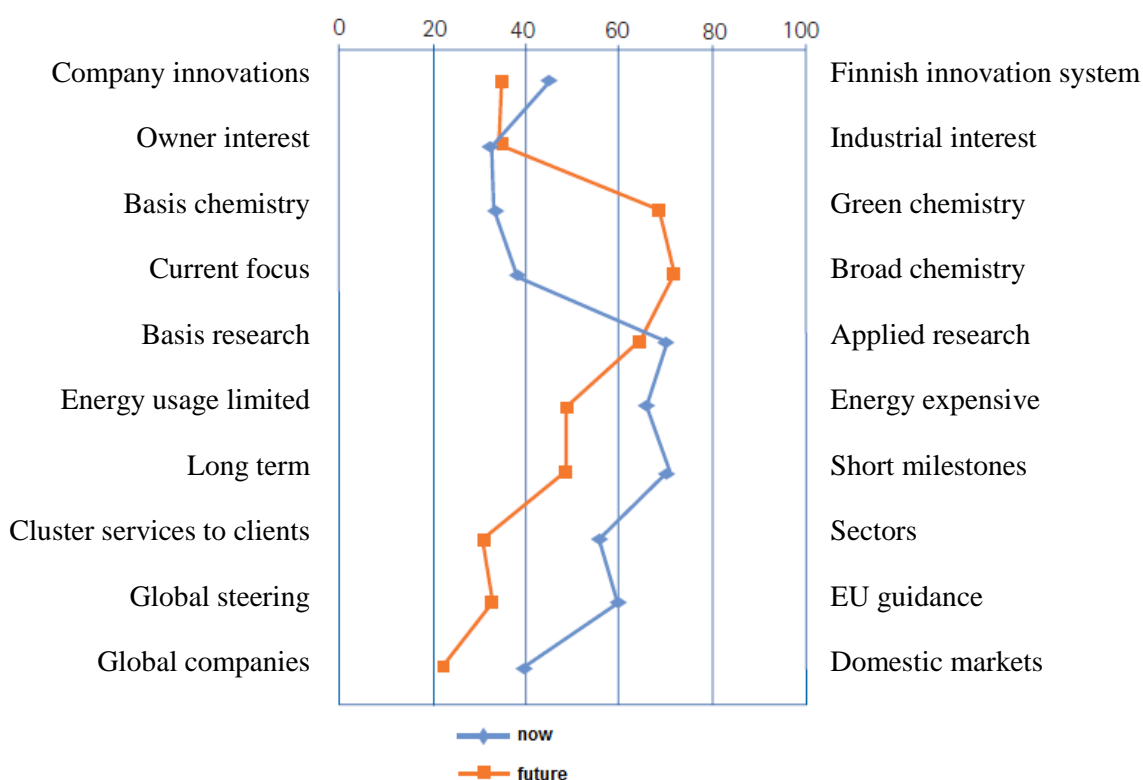


Figure 14 Beliefs of the chemical industry in 2007 and 2021. Modified from (Meristö & Kettunen, 2007)

There are also four different scenarios for the Finnish chemical industry development between 2007 and 2021 presented in the study (Meristö & Kettunen, 2007). The study regards the scenario based on the increasing discontinuity to be the most likely. The core assumptions of the scenario could be summarized as:

- Competition for energy and water will be harsh in the future. Climate change will be rapid.
- Ideological radicalism will be boosted.
- BRIC countries will compete for the economic leadership.

- Security and weapon industries will be profitable.
- The demand for the analytics devices will be increased.
- The supply of oil and raw materials will be a constant problem. There is a quest for alternative fuels.

If the world in 2021 fulfilled the above mentioned assumptions, the strengths of the Finnish chemical industry would rely on water resources, water processing technologies and high-tech analyzing devices. In addition, if the oil price continued to rise, the bioeconomy could be the next success story of the Finnish chemical industry. Furthermore, the stable business environment combined with patent protection might redirect the investments back to Finland. The weaknesses and threats are related to the small size of the Finnish chemical companies and global markets required for the niche products. Protectionism will not only decrease the market size but could also destroy the global supply chains.

3.3.3 Megatrend analysis

In the following, I am going to discuss the chemical industry development in megatrend framework. Figure 15 shows how different megatrends might affect the chemical industry development during the next decades. Like in previous chapters, the positive effect is depicted with a point outside the red circle. If the megatrend is expected to have a negative effect on the chemical industry, the point is set inside the red circle. Neutral effect is marked with a point in the red circle.

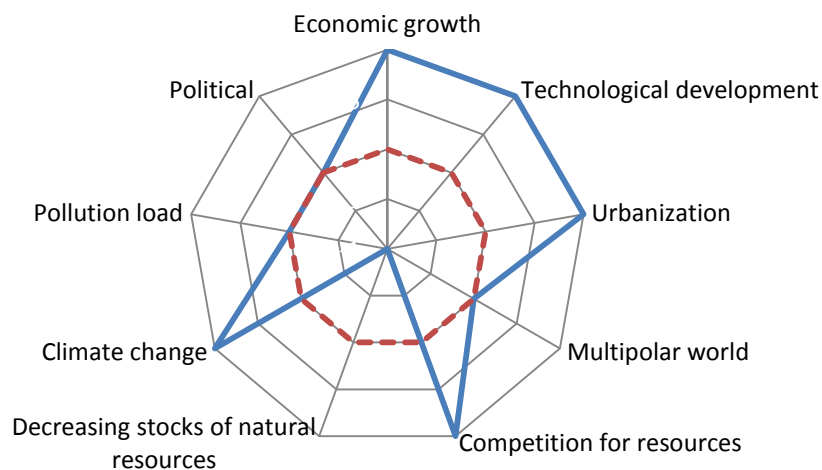


Figure 15 Chemical industry in the megatrend framework

Each megatrend's impact on the chemical industry is discussed next.

Economic growth

Economic growth has a positive effect on the Finnish chemical industry. The economic growth affects the industry in two different ways. First of all, as consumers' wealth is increased, they use more chemicals in their every-day life. Chemical, such as cosmetics and detergents, are used in the every-day life to improve the quality of life. Secondly, the increased wealth increases the demand for applications which we don't regard as chemical products in the first place but which contain chemicals or require chemicals in the production. For example, packings and many electronic devices contain many chemicals. Furthermore, chemicals are needed in many processes. There won't be drinkable tap water in many countries without chemicals. Economic growth and the chemical industry development go hand in hand.

In Finland, the chemical industry is very Business-to-Business oriented and the industry products are mainly sold as intermediate goods to other industries. Despite the rapid economic growth in Asia, Europe is still the main market for the European chemical companies. In Europe the economic growth is expected to be moderate during the next decades, which challenges the European chemical industry. A study of A.T. Kearney (2012) suggests that the European chemical industry will grow only 1 % on average during the next 20 years. The demand for some segments, such as medicines, could be boosted due to the demographic changes in the Europe and North America. Asian chemical companies are, however, expected to grow rapidly in the next decades and supply the increasing demand in Asia. It should also be noted that in many Asian countries the markets are much segmented and the local companies are government backed. (Meristö & Kettunen, 2007)

Technological development

The technological convergence of the chemical industry and other sectors is likely to be strengthening in the future. Currently chemical industry manufactures many intermediate goods for other sectors and there are no evidences that this correlation would change in the future. Like depicted in Figure 14, chemical industry is focusing on cluster services, where the technological limits are vanished. Furthermore, some segments, like future chemical and forest industry will resemble more each other and they are likely to compete from the same resources.

Technology development in totally new areas will also affect the industry development. For example, nanoscience could open many new doors to chemical industry. As there will be new innovations in the chemical industry in the next decades, the IPR issues will become more important. Can the company be sure that it IPR rights and innovations are protected when company

is manufacturing in China? Compared with many countries, the Finnish IPR protection is very trustworthy and it is respected by other companies. (Meristö & Kettunen, 2007)

A.T. Kearney study states that the innovation will change the chemical industry structure in the future, but globally the changes will be small due to huge demand for basic chemicals in the emerging countries. The supply of new innovations will grow, but at the same time, the demand for the traditional products grows, and thus the overall structure of the branch will not be changed remarkably. The same study also predicts that there won't be any technological breakthroughs in the coming decades but the innovations are to be done in the niche markets and specialty chemicals. Due to the high R&D investments, the Finnish chemical industry could succeed in these markets. (A.T. Kearney, 2012)

As I have discussed in the gigatrend chapter, the world will speed up. The same could be seen also in the chemical industry. Innovations will penetrate markets quicker and the product life cycles are shorter than ever before (Roland Berger , 2011). It is crucial for companies to introduce new products at the right time. In generally, there have been two ways to do this – R&D investments and mergers and acquisitions. According to (Booz&Co., 2012) study mergers and acquisitions are currently the easiest way to grow and 90 % of companies are expecting to buy or to be bought by other companies (KPMG, 2012).

Urbanization

The urbanization has similar kind of influence on the chemical industry than the economic growth. Urban people use more chemicals both directly and indirectly than the rural living people. The water and drain infrastructure, for example, need several kind of chemicals to work. Chemicals needed in the urban infrastructure are typically bulk chemicals, and thus the increased demand is expected to be fulfilled by the rising companies in Asia.

In addition to the increased demand, there are also other aspects which will boost the chemical industry. A.T. Kearney study (2012) highlights the “urban mining” as a potential market for the chemical industry. By urban mining is meant the recuperation of the valuable materials from the waste. According to the Finnish chemical industry association, the waste management is one of the core competences of the Finnish chemical industry, so there could be business potential in the sector for the industry. (Meristö & Kettunen, 2007)

Multipolar world

The focus of the chemical industry will be moved from Europe and North America to Asia in the next years due to the rapid economic growth and market opportunities in Asia (A.T. Kearney, 2012). Currently 50 % of the chemical sales will come from Asia but with the help of the domestic markets, Asian chemical companies will master 2/3 of the total chemical markets in 2030 (A.T. Kearney, 2012). This change will have tremendous consequences on the chemical trade flows. Currently, the flow has been from Europe and North America to Asia but in the future the chemicals are likely to flow the opposite direction.

The Finnish chemical companies are facing challenges when the markets are moved to Asian countries. The European companies have focused mainly on the European market, which is expected to slow down in the future. In addition, it might be very difficult for small Finnish chemical companies to stabilize themselves in the Asian markets. Markets in Asia fragmented and the government is very often involved in the decision, which might hinder Finnish chemical companies to penetrate to Asian markets. (A.T. Kearney, 2012)

The multipolarization of the world means also that the supply and distribution channels will become more complex. The Finnish chemical industry regards supply chains, which are becoming more complicated, as an opportunity for the Finnish industry (Meristö & Kettunen, 2007). The stable countries, such as Finland, are expected to be favored to non-stable countries as the supply chains become more complex and vulnerable. Challenges of the supply chain management in the multipolarized world are also highlighted in a KPMG study. Globally chemical companies' top concern is global competitions influence on the supply chains. Nevertheless, when assessing the regional threats there are major differences. European chemical companies are the most worried about the global competitions influence on the supply chains whereas the Asian counterparts fear natural disasters and lack of supply chain capacity. In US the rising commodity costs are more serious concern than in Europe or in Asia. Despite the markets are global the challenges in different location are very diverse. (KPMG, 2012)

Finnish chemical industry points out increasing risks for global conflicts in a multipolar world. As the emerging countries will gain more power in the global economy, and thus in the politics as well, political conflicts are more likely due to increased amount of decision makers and their different goals. The multipolarization could limit the access to the resources. (Meristö & Kettunen, 2007)

Competition for resources

The competition for resources will affect the chemical industry in the future. The companies within chemical industry need to compete with each other for the resources but also against companies from the different sectors. In the future, the technologies will converge and the same resources, for example forest fibre, could be used as raw material for different products. The rivalry between chemical companies could be analyzed with the help of a Ronald Berger figure. The figure below shows the dependence on the share of specialties and the EBIT margin. (Roland Berger , 2011)

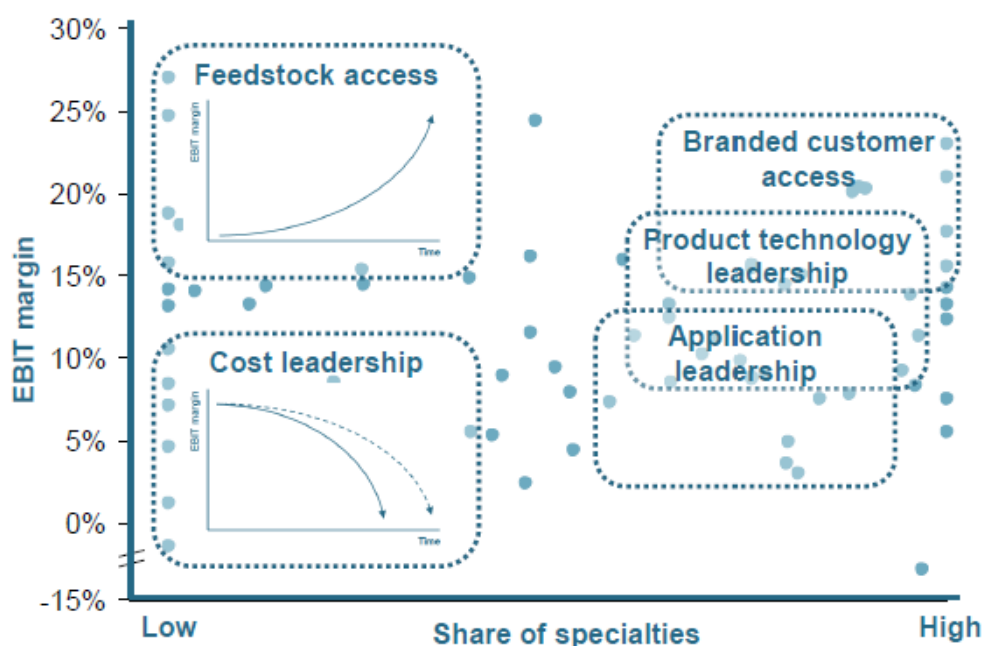


Figure 16 Share of specialties compared to EBIT. Source (Roland Berger , 2011)

Companies, which have positioned themselves in high the specialty segment, could be categorized as application leaders, product technology leaders or branded customer access companies. The low specialty companies could be divided into companies which enjoy high feedstock access or are the cost leaders. Due to the small size of the Finnish chemical companies, many of them could be positioned in the high specialty segment, where the access to resources or the cost leadership are not crucial differentiators. One exception to this could, however, be water treatment technologies. Finland has large fresh water reservoirs in which the chemical industry could rely on. According to the study done by the Finnish Chemical Industry, the Finnish chemical industry is likely to focus on the application leadership (Meristö & Kettunen, 2007).

Decreasing stock of natural resources

Chemical industry is extremely dependent on oil and gas. Oil and gas are used as raw material but they are also important energy source for the industry. There have been various estimates for the mileage of the oil reserves but the A.T. Kearney study states that chemical industry will not face oil shortages before 2030 (A.T. Kearney, 2012). The study highlights that the problem is not the supply of oil, but the increased volatility caused by the oil scarcity. Chemical companies need to be aware of the increased volatility of the raw material supply and oil prices when they are deciding the future investments.

Introduction of new raw materials is expected to relief the supply volatility and renewable raw materials are forecasted to fulfill industry raw material requirements alongside the oil products. Despite the introduction of new raw materials, the chemical industry is expected to face problems in raw material and energy supply. One should also remember that oil intensive manufacturing, such as chemical industry, is highly dependent on the political development in the Middle East. OPEC possesses 80 % of the proven oil resources. The political stability in the Middle East influences directly the chemical industry risks. (Camelot Management Consultants, 2012).

Climate change and pollution load

Finnish chemical industry regards security and cleanliness as its core competence. The world struggling with the climate change and increasing pollution load, is very attracting business area for chemical companies. Demand for waste treatment and chemicals used to slow down the climate change might increase remarkable in the coming years.

The chemical industry is not only the solution to the pollution load problem but it is also one of the reasons for it. Agriculture and industries have used many toxic chemical which have caused natural disasters in the past. It is alarming that the usage of the chemicals is expected to rise in the future. Probably the majority of these chemicals do not harm the environment, but there is always the risk that some chemicals could be found toxic afterwards. There are already several limitations to the usage of chemicals in EU and the chemical industry is likely to be more regulated in the future. Global regulation is needed to prevent the dangerous chemical cocktails. Currently, the affect of single chemicals can be evaluated but the total influence of several chemicals is not known. (European Environment Agency, 2011)

Political

Meristo and Kettunen highlight three political issues that will affect the chemical industry development until 2021 (Meristö & Kettunen, 2007). They identify the development of Russia, WTO development and USA leadership as the most important political drivers for the industry. It is easy to believe that these political drivers influence of the chemical industry, but I regard the mentioned drivers as common drivers for the whole Finnish industry. In contrast to many other industries, the risk for political conflict is highlighted in vision of the Finnish chemical industry. The most probable scenario of the industry assumes that the ideological radicalism will rise and the high demand for the security and weapon industry will boost the demand for chemicals. According to the report unallied countries might benefit from conflicts. (Meristö & Kettunen, 2007)

Like I have discussed in the megatrend chapter, new political actors will be participating in the political decision making the future. Firstly, NGOs are likely to have more political influence in the future which might tighten the industry regulation. In the new framework, the companies need to pay more attention to external effects of the products to get the “license to operate”. Secondly, the public-private partnership is also expected to rise. As of the outcome of the increased public-private partnership, the industry standards are likely to be set by globally operating companies. Smaller companies need to adapt the situation.

3.3.4 Industry summary and shipping requirements

Chemical industry is expected to develop positively in the future. During the last two years chemical industry has increased the most investments in Finland (Confederation of Finnish Industries, 2013). Based on the megatrends analysis I have formed three statements about the chemical industry development.

Statement 1: The European Union will remain as the most important market for the Finnish chemical companies in the future. The chemical industry growth will take place in Asia, but it might be difficult for small companies to enter the emerging markets. Chemical industry in Europe is expected to grow slowly. Bulky chemicals are expected to flow from Asia to Europe.

Statement 2: There will be two kind companies that will succeed in the chemical industry in the future – focused specialist and integrated players (A.T. Kearney, 2012). Finnish companies have potential to succeed as focused specialists, if they have superb application or product technology knowledge.

Statement 3: Finnish freshwater and bio mass reserves could be especially important for the Finnish chemical industry in the future.

Despite the chemical industry has invested in Finland, the transportation capacity is not increased at the same pace. The reason for this could be that the transportation industry is expecting the oil volumes to decrease between 2010 and 2030 in the Baltic Sea (Andrésen & Koshelev, 2012). As Figure 17 shows, tanker capacity has been approximately the same since 2004 whereas the liquid bulk cargo tonnages have increased. The figure shows no sights about the decreasing liquid bulk cargo volumes.

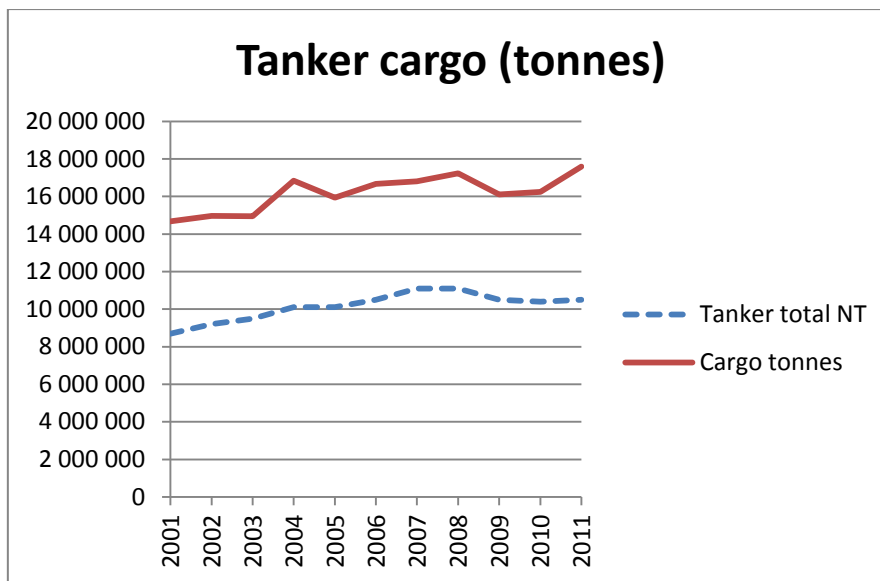


Figure 17 Liquid bulk cargo and tanker total net tonnages (NT)

The difference between the chemical industry investments and the tanker capacity could be explained by the assumption that chemical industry has invested in production which output is not liquid but solid. Fertilizers are an example of a chemical industry product that is in solid form. Other reason could be that chemical industry investments focused mainly on products which main markets are in Russia. Hence, the investments could increase the railroad investments instead of seaborne cargo. Nevertheless, a more specific study about the chemical industry development is needed to understand the industry transportation requirements.

3.4 Forest, pulp and paper

3.4.1 Industry overview

Forest, pulp and paper industry could be divided into the wood products and pulp and paper. Wood product industry consists of companies that are involved in the mechanical processing of the wood material. Sawmills and wood based panel industries are examples of the industry. Contrary to the wood products industry, pulp and paper industry produces pulp, paper, cardboard and other cellulose based products. The forest, pulp and paper industry accounts for 19.6 % of Finnish exports in 2011. (Finnish Customs, 2012)

The pulp and paper industry has traditionally been very important in the Finnish economy. Thanks to globalization and industry consolidation, the major Finnish forest industry companies are among top 10 companies in the world by the turnover (Finnish Forest Industries Federation, 2012). During the last few years the industry has, however, faced dramatic changes due to the overcapacity in production and decreasing demand for paper. Companies have tried to adjust their operations by closing tens of paper and pulp mills during the early 21st century. There is no doubt whether the pulp and paper industry is facing a structural change or not. According to a PwC survey, the most forest, paper and packing executives think that the industry has changed but there will be even more changes in the future (PwC, 2011).

3.4.2 Industry trends

It is estimated that the European forest industry will grow in next decades at the same pace as the average European economic growth (Finnish Forest Industries Federation, 2012). Despite the common growth forecast for mechanical and chemical forest industries, industries' development is expected to split. The future of the pulp and paper industry seems currently very unstable and unpredictable whereas the wood product industry is expected to face more stable development.

Demand for traditional pulp and paper industry products is decreasing and the industry is expecting "bioeconomy" to provide new business potential for the forest industry. A natural resource strategy for Finland highlights the importance of the bioeconomy (Sitra - The Finnish Innovation Fund, 2009). According to the strategy, new business opportunities will emerge from the conversion of different biomasses to chemicals and fibres. Currently, however, new products for the bioeconomy are still in the investment phase and they do not provide positive cash flow (Stora Enso, 2012). New, high value products are definitely an interesting possibility for the pulp and paper industry, but there are several companies competing for the same markets and resources. Companies are not

only pulp and paper companies but also companies from other branches. PwC study estimates that the competition for the wood fibre will be fierce in the future (PwC, 2011).

Compared with the unstable development in the pulp and paper industry, the development of mechanical wood product industry is expected to be more stable. If the pulp and paper industry is focusing more on the chemicals and fuels in the future, the wood industry has a different strategy to face the future issues. According to wood industry’s vision to the year 2050, the wood industry will focus on energy generation, buildings and in interior design in order to provide more value from the raw materials (Finnish Forest Industries Federation, 2010). It seems that the wood product industry is adding value to the current products instead of entering completely new markets. Strategic emphases of the wood product industry are shown in Figure 18.

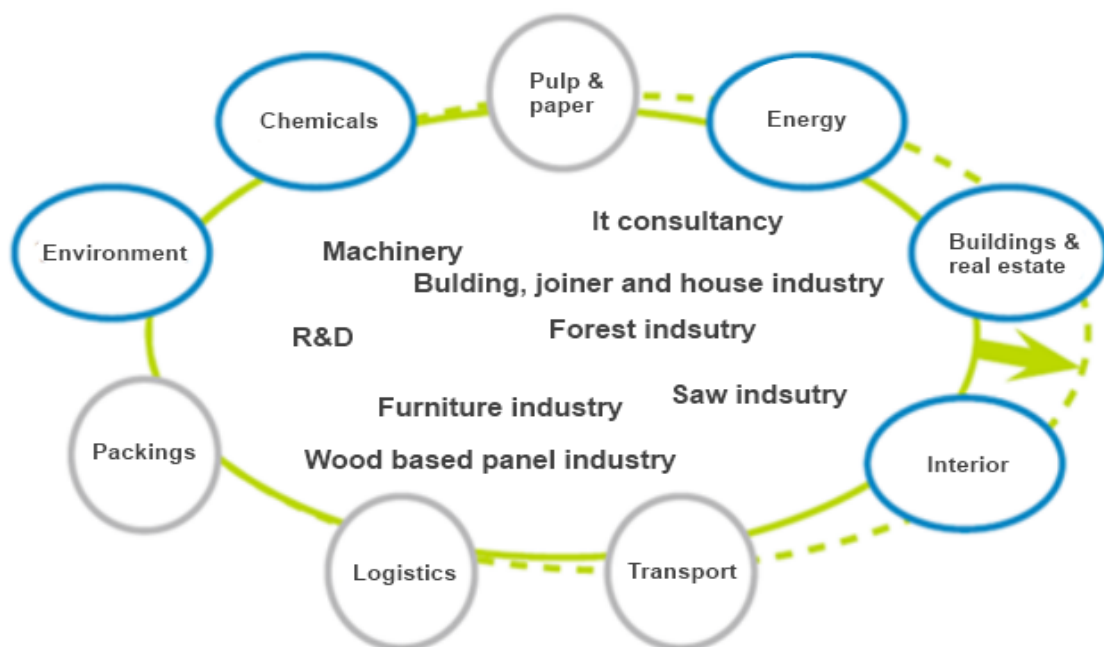


Figure 18 Strategy of Finnish wood product industry. Modified from (Finnish Forest Industries Federation, 2010)

3.4.3 Megatrend analysis

In the following I am going to discuss the forest, pulp and paper industry in the megatrends framework. Firstly, the influence of each megatrend is depicted in Figure 19. Points outside the red dotted line indicate positive effect on the industry. If the megatrend is expected to have negative effect on the industry development, the point is set inside the red dotted circle. Neutral effect is marked with a point in the circle. Secondly, each megatrend's influence is discussed more detailed. The industry development is summarized at the end of the chapter.

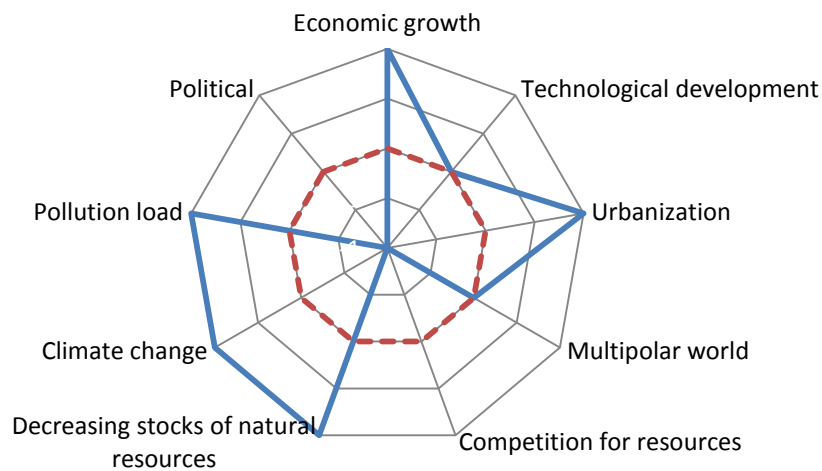


Figure 19 Forest, pulp and paper industry in megatrend framework

Economic growth

The economic growth is likely to have a positive effect on the pulp and paper industry. In the moderate economic growth locations, the demand for the pulp and paper industry products is expected to stay relatively constant in the future. Despite there are no radical changes, the market structure might be changed. New technologies will decrease the demand for traditional paper products but also create markets for more intelligent paper products. In addition, one should note that demographic trends might be favorable for the pulp and paper industry. The smaller the household sizes are, the more packings are needed. In the emerging markets, increasing consumption supports the pulp and paper industry growth. In addition to enlarged markets for basic paper products, increased living standards boost the demand for paper-based hygiene products. (CEPI, 2011)

The economic growth is likely to have positive effect on the chemical forest industry. In contrast to the fibre based industry, the economic growth might not be a silver bullet for the wood product

industry. The economic growth is expected to happen in countries where the wood has not been popular raw material for the buildings. Thus, the high economic growth in Asia and Latin America do not automatically mean increased markets for the mechanical forest industry. The industry is more dependent on the renovation in the Europe and North America. (Finnish Forest Industries Federation, 2006).

In 2011, the mechanical forest industry turnover in Finland was 6.9 billion Euros and 13.8 billion Euros in the pulp and paper sector. Thus, about 2/3 of the Finnish forest industry turnover comes pulp and paper industry. Despite CEPI estimates that the European paper industry will grow 1 % annually, the growth of Finnish forest industry will be much lower. The problem in the Finnish pulp and paper industry seems to be the wrong kind of capacity and its location too far from the consumers. In 2009 only 3.1 million tons of the total production of 41.6 million tones was cardboard, the demand for which is expected to increase. Furthermore, the increased demand for packing might not have that positive effect on the industry. Generally, paper and cardboard should be manufactured as close as possible the customers and the masses there were the raw material costs are the lowest. (Hetemäki & Hänninen, 2009)

Technological development

Technological development is expected to have a major influence on the Finnish forest industry. Like I discussed in the megatrend chapter, technological convergence will be crucial in the future technology development. Especially important technological convergence will be for the forest industry companies which future strategies are based on the bioeconomy. To generate the maximum value of the fibre, close cooperation between other sectors is needed. It makes sense that the forest companies need to make close cooperation with other sectors to provide chemicals, medicines and bioenergy. A current example of the technological convergence is the cooperation between forest and electronics industry. Electronics are already embedded in paper products in RFID applications. Next steps towards the bioeconomy could be sustainable plastics. With the help of the forest industry, plastic producers might be able to produce plastics that have smaller influence on the environment. (PwC, 2011)

If the industry trend is to integrate new technologies into the current products, how would that affect the industry volumes? Figure 20 shows the Finnish forest industry vision about the product portfolio changes in the future (Finnish Forest Industries Federation, 2011). As one can see from the figure, the forest industry wants to focus on high value products in the future. At the same time when the industry focus shifts from bulky materials to complex biomaterials, volumes will be

decreased. The focus on the lower volumes is also highlighted by the industry vision to base the billing on products and services instead of volumes (Finnish Forest Industries Federation, 2010). PwC (2011) also highlights the importance of the new functionalities as the key driver for the paper industry. They estimate that the paper sales will not be driven by the volumes but by added value such as embedded sensors.

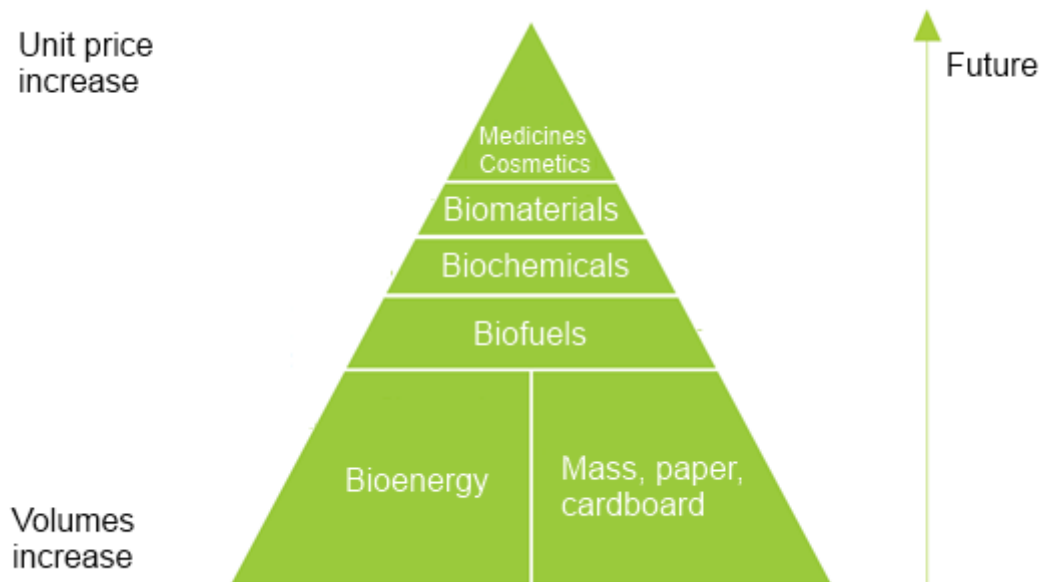


Figure 20 Future focus of forest industry. Modified from (Finnish Forest Industries Federation, 2011)

Despite the forest industry is basing its vision to the future bioeconomy, such as next generation biofuels, the forest industry has cut the investments by 16.1 % from 2011 to 2012 and the investments in 2013 are expected to be 12.1 % lower than in 2012. Chemical industry, which is also focusing on the bioeconomy and biofuels, was contrary to forest industry investing 32.5 % more in 2012 than one year before. According to current statistics, the chemical industry will have much better positions to succeed in the bioeconomy than the forest industry. (Confederation of Finnish Industries, 2013)

Another technology trend that is expected to affect the forest industry is the technological substitution. There will be new products that will substitute the forest industry products. For example, the emergence of digital media has decreased the demand for the newspaper (PwC, 2011). The substitution is not, however, one directional – wood products are also expected to substitute materials that are not as green as wood products. For example, it is expected that the wood will replace high energy intensive materials in the construction business (Finnish Forest Industries Federation, 2012).

Urbanization

70 % of the wood products are used in construction. Currently the largest markets for the wood construction are in Europe and Northern America. In emerging countries wood is not used as construction material in the same scale as in Europe and Northern America, but there are several drivers that might increase the demand for wood as construction material. First of all, wood is very environmental friendly construction material. The CO₂ emissions of construction could be remarkable decreased if more wood were used. In the New York City, for example, there are tax incentives for the green buildings (PwC, 2011). Environmental legislation and increased urbanization might thus increase the demand for wood. Figure 21 shows the emissions of different construction materials. Wood is the only construction material which decreases the CO₂ emissions.

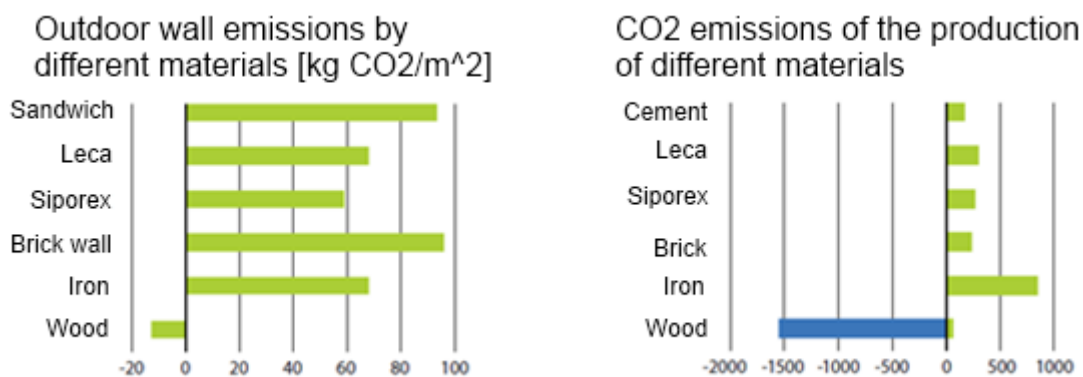


Figure 21 Emissions of different construction materials. (Finnish Forest Industries Federation, 2011)

Furthermore, wood products might be an easy way to differentiate the buildings. It is forecasted that the consumers want to mirror their values through the purchasing decisions, so this could be a market potential for the wood product industry.

Competition for resources

Competition for resources is going to be especially fierce in the future bioeconomy. Despite the wood fibre is a renewable raw material, it is not infinite resource. PwC report (2011) forecasts that many industries will be competing for the fibre resources. In the bioeconomy, energy, utilities, chemicals and potentially many other industries need fibres as their raw materials. There will also be competition for resources outside the bioeconomy. Food production for example is rivaling for the same land as the forest industry.

Compared with many other industries, the forest industry has good circumstances to succeed in the bioeconomy because the industry has wide knowledge about the raw material, it has logistics and

systems in place to develop the business (CEPI, 2011). The industry patterns could, however, change radically when new actors come to markets. Due to the ongoing structural change in the forest industry, companies might have difficulties financing investments and react to market changes. Generally, one could state that industries which will derive the most value of the raw material, and are thus able to pay the most for the raw material, will have access to raw fibre raw material in the future. There is already volatility in the supply of quality wood stock and the forest industry is adjusting to the new situation by decreasing the production of saw products and by increasing the wood imports (Finnish Forest Industries Federation, 2012). In the future the volatility will be even higher because more industries are competing for the same resources.

Decreasing stock

Like many other industries, forest industry is dependent on the oil reserves. Decreasing oil reserves affect energy prices but also the forest industry raw material supply. As the oil reserves decrease, the quest for substitute raw materials will be intensified in other branches. In many cases wood could be cost-efficient substitute for the oil based raw materials. In the future, the wood material will be more strategic raw material, supply of which companies and countries want to secure (Finnish Forest Industries Federation, 2012).

Furthermore, alternative raw materials could decrease the volatility of the raw material supply. The more variety there will be in the raw material supply, the less it is affected by one component's changes. The strategic importance of the wood material will increase also due to the imbalance between the supply and demand. PwC study (2011) estimates that the technology development could boost the demand for fibres and wood suddenly and the companies will face challenges to adjust the supply quick enough.

Currently, the Finnish forest industry is almost energy self-sufficient (Finnish Forest Industries Federation, 2010). As the energy prices are expected to rise, the more important the energy self-sufficiency will be for the industry development. In addition, the implementation of new closed cycle methods might improve the energy self-sufficiency and value added per raw material unit (Sitra - The Finnish Innovation Fund, 2009). New methods are essential for the forest industry as it is competing against other sectors for decreasing resources.

Climate change and pollution load

Climate change is going to have diverse outcomes in different parts of the globe. The Finnish meteorological institute has forecasted that the climate change could have positive effects on the

Finnish forest industry due to the fastened forest growth (Finnish Environment Institute, Aalto University, Finnish Meteorological Institute). Fastened forest growth would definitely have a positive effect on the Finnish forest industry, but one should note that forest industry is a global business and global problems will influence the industry development.

In the long run, increased energy awareness will boost the demand for bioproducts produced by the forest industry. By the substituting old materials with bioproducts emissions could be cut. For example, the emissions of wooden construction materials are significantly lower than the emissions of cement or steel. According to Finnish forest industry, the current emission trading system and the governmental subsidies to the green production are expected to boost the usage of the wood (Finnish Forest Industries Federation, 2012).

The climate change is not only a possibility for the forest industry but there are also threats involved. Forests are not only raw material source for the forest industry but they have several other functions as well. To mention a few, forests contain very complex ecosystems and they are able to capture CO₂ from the air. As the biodiversity loss is regarded as one of the most severe threats to the sustainable development on the Earth, there might be increased restrictions for the forest harvest. Furthermore, the ability to capture CO₂ might be preferred to paper production in the future. To slow down the deforestation, the cellulose production is expected to be moved to planted forests. (PwC, 2011)

Political

Like discussed in the previous chapter, the forest is not only the raw material source for the industry but it has many other purposes too. Forest ecosystems are vital to many species and the retention of those is valued. There are also non financial aspects in forests that people value – for example many activities take place in the forest such as orienteering, hunting or picking of the berries. Why should these non-financial values be taken into account when analyzing the industry development? The reason is in the ownership structure of the Finnish forests. In Finland, the average size of forest estate is low and about 50 % of the forest is owned by individuals. Individual owners might prefer the non financial values to the economics ones which might lead to decreasing amount of industrial forests (Finnish Forest Industries Federation, 2006).

The decreasing size of forest estate combined with the increasing certification could change the industry patterns. Industry has voluntarily done certification of the forests to ensure the balance between the environmental aspects and the economic aspects. As the political field becomes more

diversified, forest certification might increase which might have a negative effect on the raw material supply. Due to the alternative usages of the forest and land, there is likely to be debates about the sustainability of the forest industry in the future.

3.4.4 Industry summary and shipping requirements

Like discussed earlier, forest, pulp and paper industry is facing a structural change. There have already been remarkable changes in the industry but many changes are still to come. Due to the industry restructuration, industry future is very challenging to forecast. Next I am still trying to predict trends that might affect the industry development.

Statement 1: The wood product industry is driven by more specialized and more processed materials. Overall volumes of the wood product industry are not expected to change dramatically in the future.

Statement 2: Production of the pulp and paper industry is expected to decrease dramatically in the coming years. Overcapacity and decreasing demand for traditional products Europe challenge the Finnish pulp and paper production.

Statement 3: Despite the forest industry is looking forward to the bioeconomy and new products, industry investments have been decreasing. Investments are, however, crucial for companies to succeed in the bioeconomy. Current operational cost cuttings are definitely needed, but they are not the key to new business opportunities.

From the shipping point of view, pulp and paper industry cargo volumes are expected to diminish remarkably in the future. To limit export cargo costs, ship-owners should pay attention to efficient transportation capacity usage. Low export volumes combined with empty ships sailing back to Finland is not a sustainable equation. Thus, transportation capacity utilization rate should be improved for example by more agile vessel types which could export pulp and paper products but import other goods.

Transportation agility will be beneficial in the wood product industry as well. In the wood product industry cargo volumes are not expected to decrease as much in the pulp and paper but to remain approximately at current levels. Nevertheless, wood product industry is trying to shift the focus from bulky materials to more advanced materials and products. Despite no major changes in transportation volumes are ahead, ship-owners should be aware of the industry vision. Bulkers might not be the optimal way to transport new product types.

3.5 Technology

The analysis of the technology industry is especially difficult. There are several technologies and business models within the technology sector and each of these will be affected differently by megatrends. To ease the analysis task, I will focus on machine and vehicle industry, electronics and electrical engineering industries in the thesis. In addition, the purpose of the analysis is to identify key external drivers that will affect the overall industry development and business environment.

3.5.1 Industry overview

There are several different industries under the umbrella of technology industry. The industry consist of electronics and electrical engineering industry, machine and metal product industry, metal refining, information technology and even of planning and consulting activities. In the thesis context, the focus is, however, on the machine and electronics and electrical engineering industries. The trends of the metal industry are covered in the metal and mining section. Furthermore, the transport requirements of the information technology and planning and consulting industries are minor compared with the metal and electronics sectors. Thus, ICT and consulting businesses are also excluded from the analysis. Products and services created by these sectors are usually delivered to customers via electronic delivery channels or created at the customer location.

Technology industry has been one of the most important industry sectors – or maybe the most important – in Finland during the last decades. According to Turunen (2011), the technology industry exports 60 % of the Finnish total export and employees indirectly almost every fourth in the Finnish workforce. In the following, I am going to introduce electronic and electrical engineering sectors and machine industry more precisely.

Electronics and electrical engineering sector has been very important exporter in the early 2000s in Finland. In 2000 the sector was the biggest exporter in Finland, with a share of over 30 %, but its relative share of the export has been decreases since that. Figure 22 shows the development of relative export shares of different industries in the new millennium. In 2000, over 30 % of the export was electronics and electrical engineering industry products whereas in 2011 the relative share was sunk below 15 % of the total export (Finnish Customs, 2012).

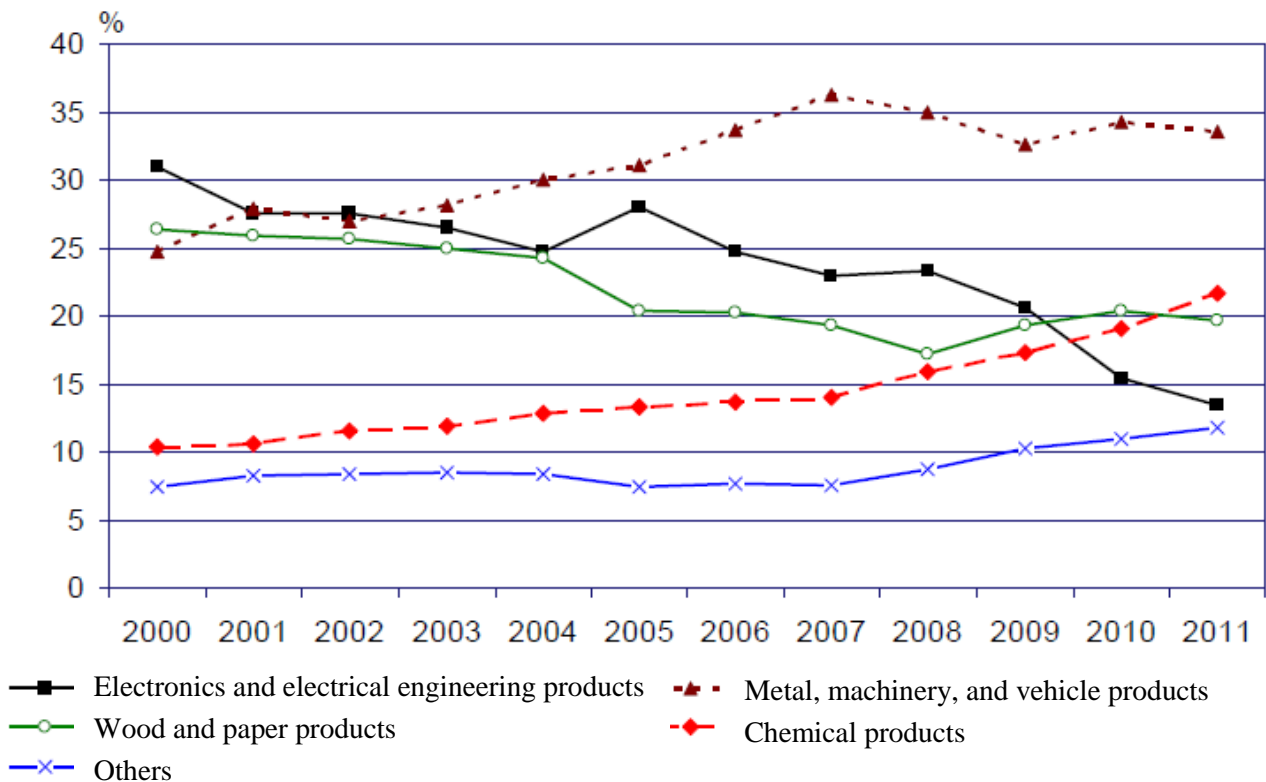


Figure 22 Industry shares of Finnish total export (Finnish Customs, 2012)

What is then the electronic industry and what is the difference between electronics and electrical engineering industry? I use a classification which follows the classification of Statistics Finland. Electronic industry corresponds to the TOL 2008 class 26 “Manufacture of computer, electronic and optical products” and electrical engineering industry the TOL 2008 class 27 “Manufacture of electrical equipment.” Practical examples of an electronic industry product would be a cell phone or a hear rate monitoring watch. Electrical engineering sector manufactures products such as electric motors or frequency converters. (Statistics Finland)

The electronics and electrical engineering industry turnover was 2010 4 081 million Euros. The three biggest companies within the industry are Nokia, ABB and PCK group. (Höykinpuro, 2012)

As one can see from Figure 22, the machine industry has been the biggest exporter in Finland since 2003. In 2011, almost 35 % of the Finnish export was machinery or metal industry products. Among the three biggest machine industry companies in Finland are Kone, Metso, Wärtsilä. The Finnish metal industry is characterized by the fact the vast majority of the companies are small or medium sized but the majority of employees work for big companies. (Pajarinen, Rouvinen, & Ylä-Anttila, 2012).

3.5.2 Industry trends

Pajarinen et al. (2012) have stated in their report that “*machine industry produces investment goods that other industries use and in which the currently available technology is embedded.*” Traditionally, the knowledge captured in the machines has been engineering knowledge which is then used to improve processes in different industries. The world is, however, changing. In the western society, more and more of the GDP will be generated in the service sector. Vargo and Lusch have for example introduced the concept of service dominant logic, which highlights the importance of the service as the fundamental basis of exchange. The value is not anymore delivered through goods but through services (Vargo & Lusch, 2008).

This fundamental change has already changed many business models in the Finnish machine industry. The Finnish machine industry is not any more building elevators or cranes but it is “*dedicated to move people*” or to “*lifting businesses*”. Machine industry has not only changed the slogans but there are true business model changes beyond the slogan changes. Pajarinen et al. (2012) have depicted this change by two pyramids (Figure 23). Earlier the manufacturing was the core of the business but nowadays the pyramid is upside down, and the logistics, finance, R&D and other services have become the core competence.

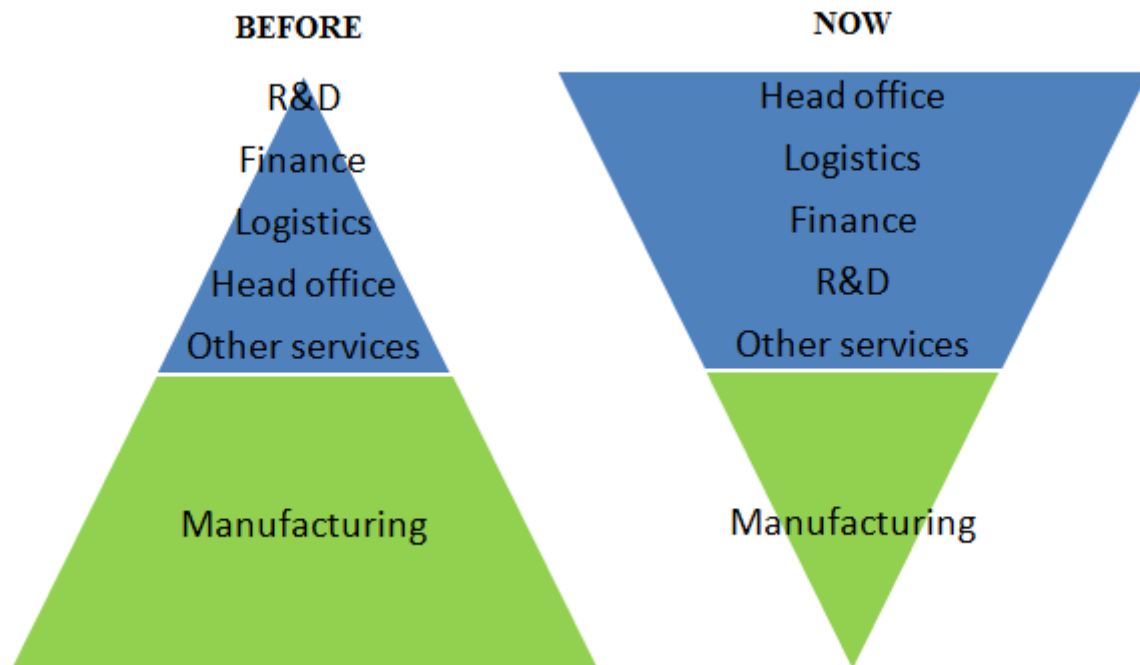


Figure 23 Focus of manufacturing companies before and now. (Pajarinen, Rouvinen, & Ylä-Anttila, 2012)

Compared with the machine industry, which has increased order books since 2005, the electronic industry has suffered from a major decrease in the order books. One reason for this rapid decrease

has been the fall of Nokia. Another reason for this could be the fact that the electronic industry structure is remarkable different from the one in the mechanical industry. The machine industry produces mainly investment goods whereas the electronic industry is heavily focused on the consumer goods. Finland has not been able to compete with the low cost countries in the high volatile consumer electronics sector.

Electrical engineering industry resembles the machine industry in many ways. Electrical engineering sector produces goods that are investment type and the volumes of these products are much lower than the volumes in the electronics sector. As the machine industry has added services in their offerings, electronics and electrical engineering sectors have not yet been fascinated by the services. Of course there are a few exceptions, like Vaisala, but generally services are not bundled with the electronics devices nor electrical engineering equipment. One reason for this could be that services are created in different location than the product is used. In order to use cloud services, you don't need to have a clue about the hardware that is enabling the service. Compared with the electronics industry, the crane operation services are closer linked to the movements of the cargo. As the added value is diverging from the electronics products, the bulky producers and the low cost countries are likely to dominate the market in the future. The market niche for Finnish producers might be in high value adding services.

3.5.3 Megatrend analysis

In the following I am going to discuss the technology industry in the megatrend framework. First, the graph of megatrend analysis is shown and after that each megatrend is discussed in the technology industry context. A positive effect on technology industry circumstances is shown with a point outside the red, dotted circle. If the megatrend is assumed to have a negative effect on the industry, the point is set inside the dotted circle.

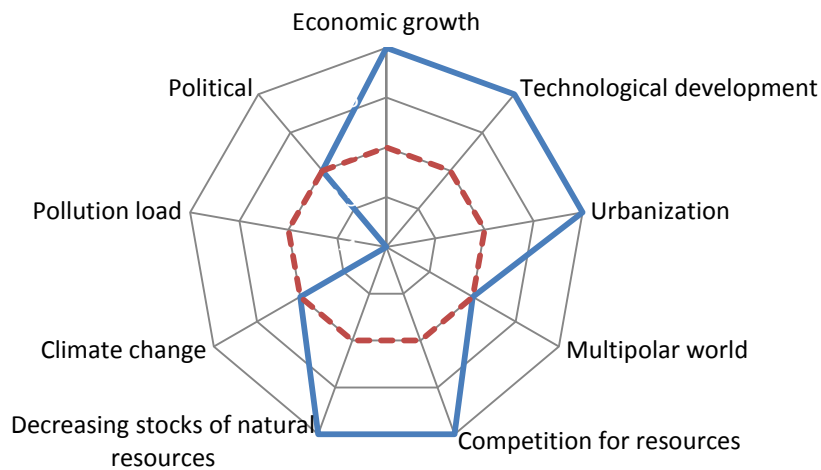


Figure 24 Technology industry in megatrend framework

Economic growth

The economic growth will have a positive effect on the technology industry. As discussed earlier technology industry products are investments goods that are essential enablers of GDP growth. Economic growth has a direct effect on the investment good demand. Positive effects are not associated only with investments goods but the economic growth influence positively the consumer goods markets too. As there will be a bigger middle class in the future, the demand for technical applications is likely to rise remarkably. The importance of the rising middle class is depicted in the figure below.

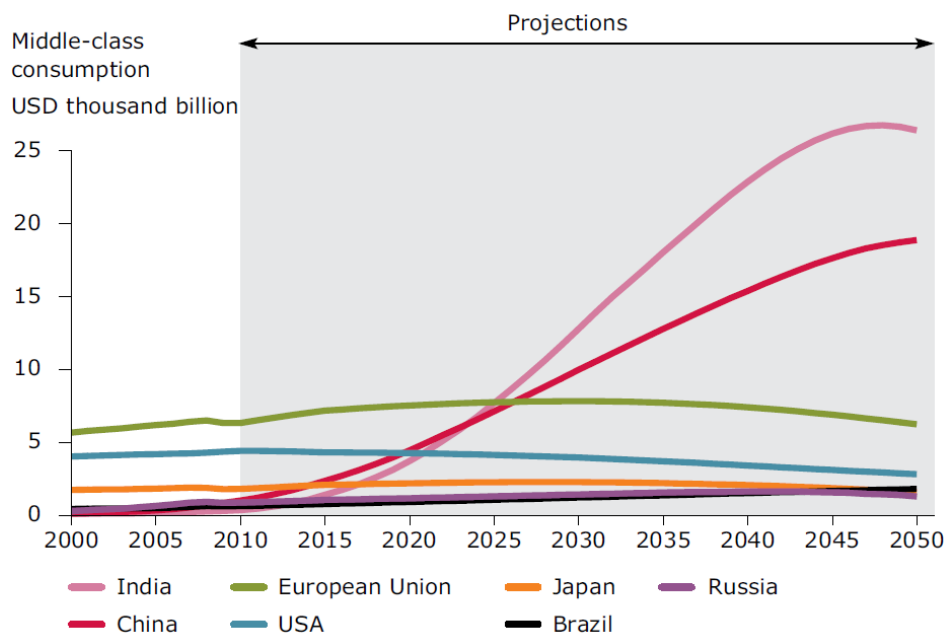


Figure 25 Changing consumer spending of the middle class (European Environment Agency, 2011)

Despite the higher amount of the spending is going to be spent in services, the demand for products will increase due to the increased amount of consumers. According to Figure 25, currently the total middle class consumption is approximately 13 thousand billion USD. The same figure indicates that in 2025 the middle class consumption will be over 30 thousand billion USD. The market volatility will be increased alongside the market volumes. Like I have discussed earlier, it is forecasted that technology cycles and trends will become shorter. As a result companies that are able to “reinvent” themselves in each technology cycle will find significant markets more frequent. In the future companies cannot assume that the markets would be stable for many years.

The influence of the economic growth might not be completely positive for the Finnish technology industry but there are also risks. As the economic growth is expected to happen outside Europe and USA, the requirements of the customers might differ radically from our expectations. Domestic companies might be able to react better to customer requirements in emerging countries. In addition, if the trends are quicker than nowadays, it might be difficult for consumer good producers to indentify the arising trends from the other side of the world. One should remember that the most important markets will be far away from Finland.

Technological development

Technological knowhow will be much higher in 2025 than today. In 2025 there will be completely new technologies but some of the current technologies will be evolved to fulfill the future needs. In addition, some of the current technologies will be found in museums in 2025. In the thesis, I am not going to forecast which technologies will succeed nor estimate how the machine industry or electronics industry could adapt new technologies. Contrary to specific technical issues, I will focus on issues that affect the industry ability to adapt new technologies.

Firstly, EK study highlights the importance of education as one of the Finnish industry core competences. The level of basic education is very high which provides good circumstances for the further education and work life. Thanks to good basic educations, it is easy for employees to adapt to changing tasks. The flexibility and the knowhow of the Finnish workforce could not be underestimated in a world where technological cycles become shorter. In addition, low organizational structures and direct information channels improve the industry flexibility. In order to improve the industry innovativeness, Finnish companies should pay more attention to the multiculturalism and non-technical innovations. Furthermore, industry culture which avoids risk taking and failure should be avoided. (Federation of Finnish Industries, 2010)

Secondly, R&D investments could be used as an indicator from the ability to adapt new technologies. According to Pajarinen et al. there has been increasing trend in the Finnish R&D investments (Pajarinen, Rouvinen, & Ylä-Anttila, 2012). Furthermore, the same study state that machine, electronics and electrical engineering industries have done more innovations than the other Finnish industries. Thus, it seems that the Finnish industry has fairly good structures to adapt new technologies.

Like it has been highlighted in the thesis before, the technology convergence will influence several industries. Nurmi et al. have stated that especially the ICT development will be closely connected with the development of other industries (2012). The same trend could be seen in other surveys. Almost 60 % of the Finnish machine industry companies will increase their own software development in the future (Pajarinen, Rouvinen, & Ylä-Anttila, 2012). The same study shows that almost 40 % of electronics companies have software development of their own but still over 50 % of the companies are expecting to increase the in-house software development.

Urbanization

Urbanization will boost the demand for technology industry products. As many technology industry products are investments goods they are needed when enormous infrastructure projects are conducted. In addition to the IT and traffic infrastructure investments, Finnish technology companies could benefit from the energy and gas investments (Hernesniemi, 2010).

Multipolarization

The multipolarization of the world is expected to have a neutral effect on the Finnish technological industry. As emerging countries enter the industrialized era, there will be changes in the Finnish competitive advantage. Production costs will be lower abroad, but all the industrial production will not move entirely to these low cost countries despite the speculations about the “China effect”. To analyze the international trade more theoretically, one could use the Heckscher-Ohlin theory. According to the Heckscher-Ohlin theory, the capital intensive Finnish industry, will export the capital intensive products whereas the low cost countries focus on the capital-abundant products.

Pajarinen et al. (2012) have stated that the strategy of the Chinese machine industry was to focus on low quality mass markets but currently they have expanded the focus on low quality niche markets and medium quality mass markets. Companies from the emerging countries are not yet capable of filling the niche markets but in the future the case could be completely different. In general, I assume that new emerging countries try first to focus on low quality and mass markets but in the

future aim at higher quality markets. From the Finnish perspective this means narrower focus on the niche products and high quality products.



Figure 26 Focus of Chinese machine companies. Modified from (Pajarinen, Rouvinen, & Ylä-Anttila, 2012)

The multipolarization and the Finnish focus on the niche products highlight the importance of flexible production but also challenge the value chains. As the market is the entire world and subassemblies origin from various locations, the transportation channels must be effective. Transportation costs are expected to rise due to increased transportation distances but also due to the higher cost per kilometer. According to a consultant study, the four most important competences of the Finnish manufacturing are

- high quality,
- deliveries on time,
- ability react to changing demand and
- ability to provide as short as possible delivery time (Deloitte, 2011).

This study strengthens the view that Finnish industry will focus mainly on niche and high-quality products in the future.

Competition for resources

Multipolarization could also have crucial effects on the supply and demand for the raw materials. Some futurists for example have forecasted that the western countries are likely to lose their power in the Middle-east oil reserves (Ahvenainen, Hietanen, & Huhtanen, 2009). As there is more competition for the resources and there might be political restrictions to the access of the raw materials, the possessed resources should be utilized as effectively as possible. The competition for the resources means not only the competition for the raw material but also for the capable workforce. Especially in the future, when the society is more information intensive, the educated workforce becomes one of the key success factors – if it still is not regarded one.

In order to maintain the globe sustainable the limited resourced should be used as effectively as possible to respond to the increasing population and growing demand for products. Ahvenainen et al. have forecasted that in 2025 over 50 % of the Finnish industry will be closed processes (Ahvenainen, Hietanen, & Huhtanen, 2009). This technical ecology would be based on five Rs – remove, reduce, reuse, renew and recycle. There is a lot of potential for new innovations in the sustainable economy. If the innovation capability is measured according to the R&D expenses, the Finnish technology industry has a fairly good position due to the steadily increased the R&D investments since 1975 (Eloranta, 2012). The investments in the real assets have, however, decreased since the 1990s. During the economic crisis in the late 10s, all the investments have decreased. One could state that the Finnish industry is transforming itself from a production industry to a design industry. The design is made in Finland and IPRs are in Finland but the production is in cheaper countries.

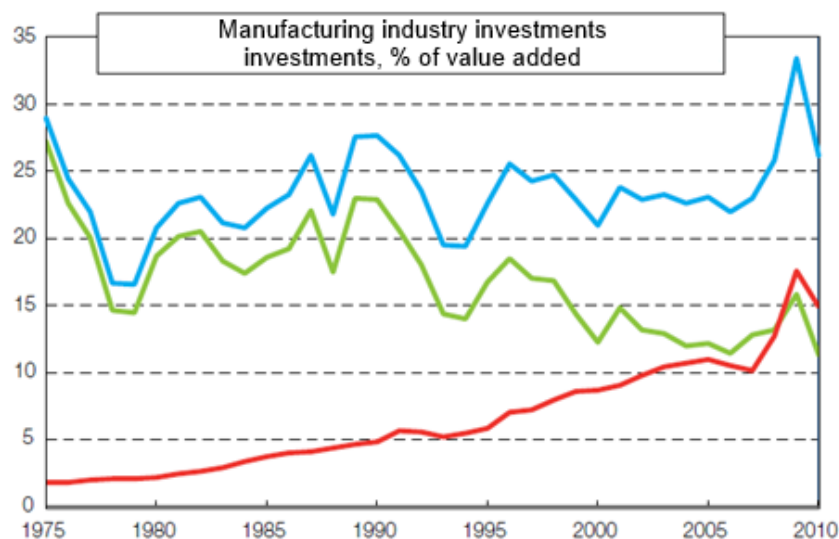


Figure 27 Investments (green), R&D expenses (red), investments + R&D % of the total value added. (Eloranta, 2012)

Climate change and increasing pollution load

The climate change is regarded as one major challenge when striving towards a sustainable planet. The main reasons for the climate change are the greenhouse gas emissions (CO₂, CH₄, O₃, N₂O) which cause the climate to warm. Currently, actions to slow down the climate change have mainly been based on the CO₂ reductions. Actions to slow down the climate change have manifested themselves in technology industry as emission trading system and increased legislation. The outcome of these actions has been increased costs for the technology industry. In addition to the climate change problem, the Finnish society is concerned about the increasing pollution load. Currently, the effect of the sulphur directive is discussed in the Finnish industry. From the Finnish technology industry point of view, the implementation of the sulphur directive decreases the industry competitiveness compared with other locations (Eloranta, 2012).

Despite the increased costs due to actions to slow down the climate change, the climate change prevention might also have positive effects on the technology industry. Due to the increased energy costs, demand for products to save energy might be increased in the future. Eloranta state that environmental technology cluster is already strong in Finland and cleantech and energy sectors are expected to grow most rapidly along with ICT sector in the future (Eloranta, 2012). The electrical engineering has been a big investor in Finnish R&D and this industry has very good potential to become the new cleantech driver for the Finnish economy. In addition, the forest industry is focusing more and more on the renewable energy. (Höykinpuro, 2012)

Political

Politics have tremendous impact on the industry development. Like discussed in the previous chapter, environmental legislation is one major concern in today's politics. Effects of the environmental politics are not limited only to environmental aspects but they do affect wider range of activities as well. For example, the mentioned sulphur directive main goal is to cut the emissions in the Baltic Sea, but at the same time it set the framework for the transportation industry.

Like discussed before, there will be new quarters represented in the future decision making. As illustrate in megatrend chapter, number of NGOs have increased remarkable during the last few years and the same trend is expected to continue. In addition, more public-private partnership is expected to happen. NGOs and companies are already very closely connected with the policy making. European parliament requires lobbyist to register in order to improve the transparency of decision making. According to the statistics, there were nearly 5500 lobbyists in the European

Parliament in 2012. 28 % of these were NGOs and 48 % represented different companies. (European Parliament, European Commission, 2013)

In the future, big policy decisions will be made at the international level. Whether it is European Union or in G8/G20 countries, there will be several countries participating in the decision making. As the policy making becomes more global, there is a risk that only the biggest NGOs and companies are taken into account in the decision making process. Thus, in the future it might be more difficult for the Finnish companies to influence the decision making.

3.5.4 Industry summary and shipping requirements

Based on the previous megatrend analysis on the Finnish technology industry I have formed the following statements of the technology industry in 2025.

Statement 1 The Finnish technology industry will focus more on producing high value investment goods to niche markets. This will highlight the importance of the adjustable production and on time deliveries.

Statement 2 Volumes of the Finnish manufacturing industry are likely to decrease due to two reasons. Firstly, the Finnish manufacturing industry will be more focused on R&D, sales and other supporting functions instead of manufacturing. Secondly, the technology industry investments have been reducing since 1990s. Decreasing investments will result as decreasing volumes in the future.

Previous statements have certain possible outcomes to the Finnish shipping industry. First of all, technology industry cargo volumes will be more volatile, especially in niche investment goods markets. Additionally, it seems that the technological trends and product cycles will be even shorter in the future than today. Hence, the predictability of the transportation volumes will decline. Ship operators and owners should thus offer customers agile transportation capacity. Flexibility is needed to meet the customer requirements that change in time but also to provide different customers the right kind of service. Even companies within the same technology segment might have radically different transportation requirements.

Secondly, despite the technology industry volumes might decrease in the future, the value of the production is expected to increase. In addition to the flexibility in the transportation the ability to deliver products on time would be more important differing factor for the Finnish technology industry. Ship operators should consider whether they should just provide manufacturing companies

standard transportation solutions or could they add new value to the transportation service that would benefit the manufacturing company and the product purchaser. As the value of the cargo increases, new business models could be adapted to the transportation business.

3.6 Commerce

3.6.1 Industry overview

According to Finnish customs statistics, intermediate and durable consumer goods account almost for a quarter of the Finnish import. A remarkable share of this import is imported by the Finnish commerce industry. In this chapter, the development of the commerce industry and its effect on the trade flows will be discussed. To be more specific, the commerce industry is limited to car trade, wholesale, retail and grocery trade. Furthermore, due to the close link between the grocery trade and food industry, the food production industry is also discussed in this chapter.

The total turnover of the commerce industry was 127 billion Euros in 2011. Within the commerce industry, the wholesale trade was the most important sector with a turnover of 74 million Euros. Retail trade included with the grocery trade accounted for 29 % of the industry turnover. The turnover of grocery trade was nearly 17 millions in 2011. Commerce industry turnover is illustrated in Figure 28. (Federation of Finnish Commerce, 2012)

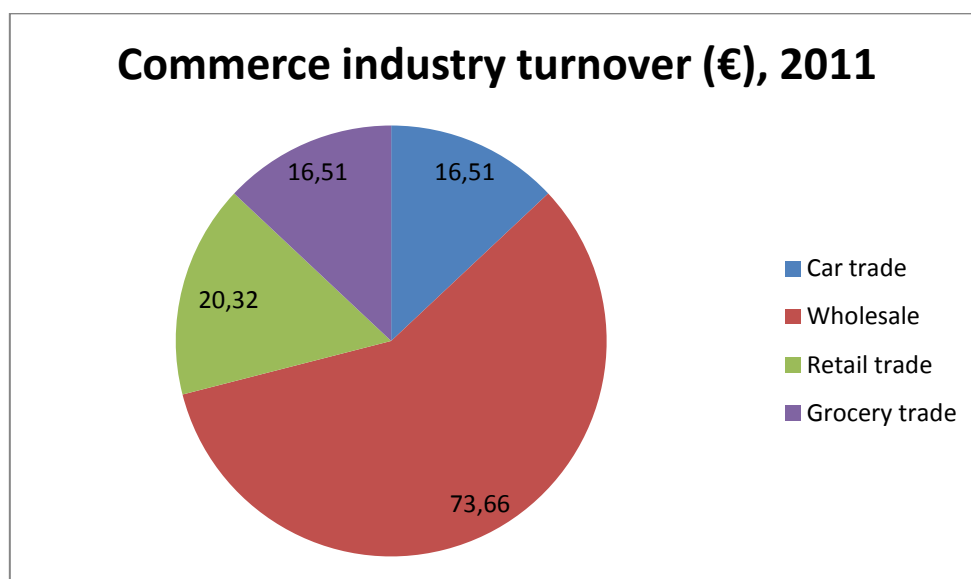


Figure 28 Commerce industry turnover (million Euros). Modified from (Federation of Finnish Commerce, 2012)

The gross value of the food production in Finland was 11.3 billion Euros in 2011. The food production industry is highly dependent on the import. In 2011, the industry imported worth 4 billion Euros whereas the export was 1.6 billion Euros. (Juutinen, 2012)

3.6.2 Industry trends

According to a study, the Finnish commerce business is extremely regulated compared with the neighboring countries. The same study also states that retailers from the heavily regulated countries

tend to have lower productivity than the counterparts in less regulated countries (Ernst & Young, 2010). The consultant company is not the only one who has paid attention to the industry regulation but the Finnish Grocery Trade Association is also looking forward to opening the markets (The Finnish Grocery Trade Association, 2009). They regard the less regulated markets as one of the competitive advantages in the future. Due to the currently high regulation the industry trend is likely to decrease the regulation than increase it. At the same time when companies are looking for more open markets, the food production industry is expecting the Finnish commerce business to be more globalized (Juutinen, 2012).

Turnover of the retail and wholesale industry increased steadily in the early 2000s. Commerce industry grew until the finance crisis in 2008, which cut heavily the industry turnover. Despite the major crisis, industry growth rates between 1995-2011 have been 4.1 % in retail trade and 2.9 % in wholesale sector. At the same time, the car sale grew by 6.9 %. In the next few years, the industry annual growth will differ radically from the historic values. Due to the prolonged financial crisis and decreasing investments, commerce industry growth will be slow down. The commerce industry has already started to adapt their operations to meet the decreasing growth rates. (Federation of Finnish Commerce, 2012)

3.6.3 Megatrend analysis

Next I will analyze the commerce industry development in the megatrend framework. Firstly, the influence of different megatrends is depicted in Figure 29. Megatrends that are outside the red, dotted circle are likely to have positive effect on the industry, whereas the megatrends inside the circle might have negative effect on the industry. A neutral effect is indicated with a point in the red, dotted circle. After the overview, each of the megatrends is discussed separately.

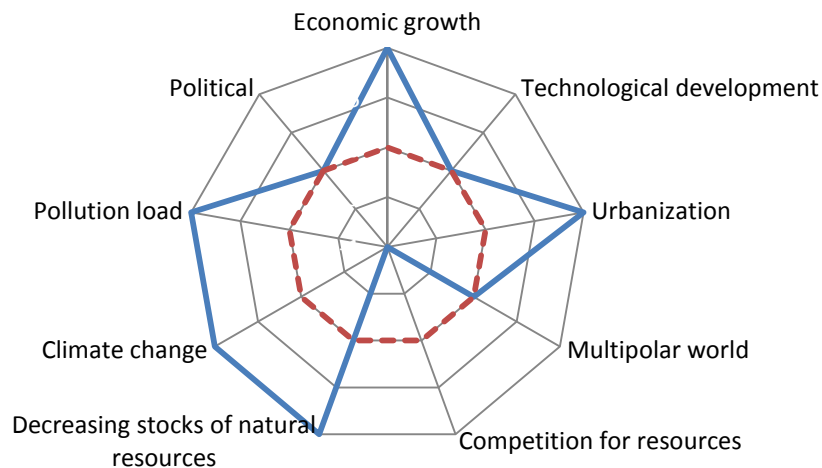


Figure 29 Commerce industry in the megatrend framework

Economic growth

There will be almost 2 billion new middle class consumers in 2030 according to the OECD scenario (Kharas, 2010). Like discussed earlier, these new middle class citizens will emerge in currently developing countries. They want to have the middle class equipment in which we are currently used to. This is likely to boost the international trade. It is also said that consumers want in the 21st century a better value for the products and products which represent the values they have (Deloitte, 2011). Despite the values in emerging countries might, however, be very different from our post-industrialized values, the massive increase in the purchasing power will boost the consumer goods industry and trade. According to the Deloitte study, there is pressure to shift the development of consumer businesses overseas to take the advantage of the emerging markets (Deloitte, 2011).

Especially in the food industry, the ability to move the production closer to consumers might be favorable. According to the Deloitte study, the transportation issues will be more important in the future. It is stated that *“With ever more global patterns of food supply, it remains critically important for businesses to ensure the end-to-end integrity of the supply chain in which they operate in the interest of protecting consumers and protecting the brands they trust* (Deloitte, 2009). This might be one reason why Finnish food industry has opened production locations abroad when they are expanding to new markets. Other reason could also be the lower production costs. Figure 30 shows the current locations of the Finnish food industry abroad.

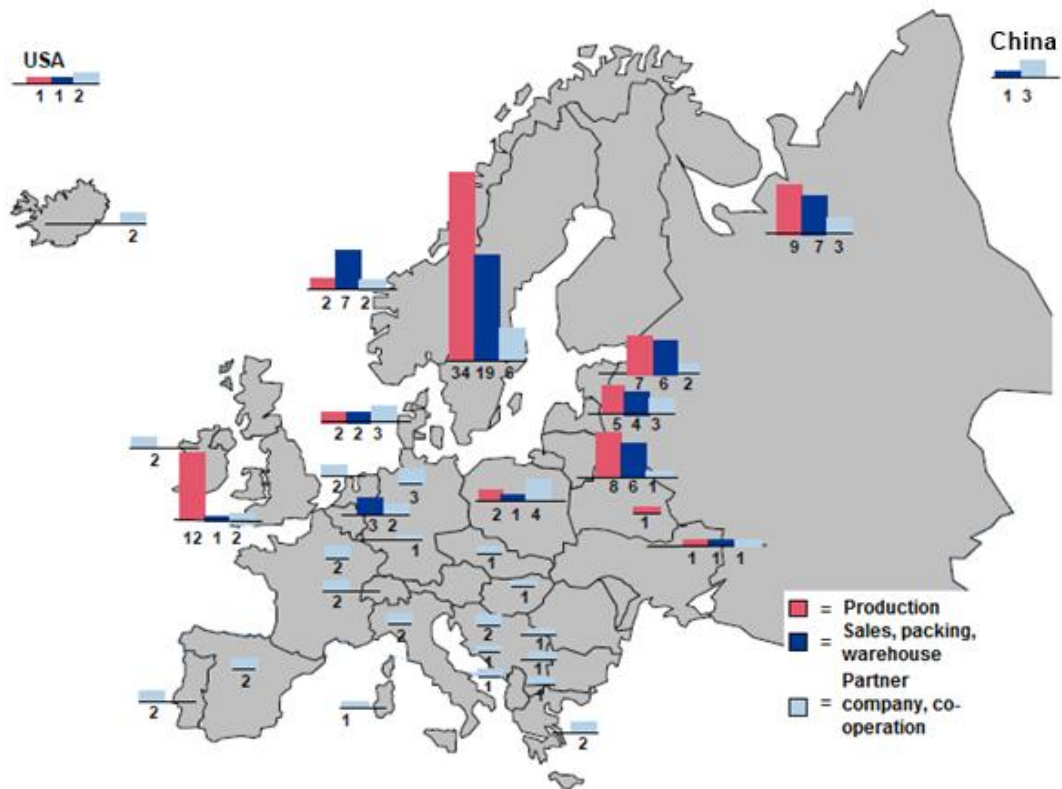


Figure 30 Finnish food industry abroad. Modified from (Juutinen, 2012)

Technological development

In contrast to the food production, the consumer goods industry has already faced a separation between consumption and production. In some cases, current technology makes it easier to purchase products from other side of the world than from the nearest boutique. If the same trend emerged in the food industry, the Finnish food industry could gain due to the high ethical and safety standards. This would, however, set enormous challenges to the transportation.

The technology development guarantees that there will be new products and services that are better, lighter and trendier than the current ones. Technology development is a solid ground for the consumer goods business where the wants – not the needs – are important. Furthermore, like discussed in the megatrend chapter, the pace of the technological development will increase in the future. This will have tremendous effect on the product cycles. The shorter the product cycles are the more often customers want to upgrade their old products. Commerce industry is an essential distributor of products, and thus it will definitely benefit from the shorter product cycles.

Technological development will have secondary outcomes to the commerce industry too. Technological development is likely to open the consumer goods markets in the future. The ability to order products via web stores increases the customer potential of the Finnish companies but also

on the other hand Finnish customers will have broad variety so they might choose foreign company as well. Due to the small volumes and individual likes, the transportation could be very challenging in the future. Current courier based delivery methods cannot be scaled up infinitely but there must be new ways to offer individual deliveries more cost-efficiently. Ernst & Young has stated that commerce industry might seek synergies by integration and concentration (Ernst & Young, 2011). It is easy to agree with a Deloitte study which states that in order to succeed in the commercial business companies need to combine the commercial knowledge with the operational one (Deloitte, 2009). In the future it is not enough for global companies to have superb commercial knowledge but the operational excellence should also be taken into account.

Urbanization

Urbanization could be regarded as one of the most important drivers in the consumer good and food business in the next decades. Cities have positive effect on the commerce for many reasons. First of all, the average incomes are higher in the cities than in rural areas. As there is strong migration from the rural areas to the urban areas, the ability to consume will be increased in the future. Secondly, customers are concentrated on the smaller areas in the urban areas. The critical mass needed to run the business could be reached easier. Urbanization could also yield to rapid changes in the food and consumer goods business. In large cities, where the transportation is very difficult, it could be easier to order products online and get the home deliveries instead of travelling for large stores located outside the cities. The Ernst & Young study states that the current consumer goods infrastructure might not be able to cope with these issues very flexible. (Ernst & Young, 2011)

Multipolarization

The world is expected to develop differently in different parts of the globe. Some say that in consumer business the world will not be multipolarized but the consumption imbalance between locations will be decreased (Deloitte, 2011). Whatever the view point is, the fact is that the economic power is to be shifted to the BRIC (Brazil, Russia, India, China) countries. At the same, time the economic growth in the western countries is expected to remain stable.

Different growth paths are also visible in the food and consumer goods business. One indicator of the expected slow growth rates in Finland is layoffs. According to the Federation of Finnish Commerce, the industry has started to adjust the employment requirements to meet the decreasing growth pace (Federation of Finnish Commerce, 2012). On the other hand, the demand will increase

rapidly in the emerging countries. BRIC countries and Indonesia, Turkey, Vietnam and Mexico will become the most intriguing markets for the consumer oriented companies (Deloitte, 2011).

However, do the same products sell in Mexico than in Turkey? Especially in the food industry the local likes might be crucial. According to Ernst & Young interview Finnish sausages will not sell in Sweden without modifications (Ernst & Young, 2011). A Deloitte study also highlights the importance of the customer knowledge and different selection for different consumers as key competences in the food and consumer business (Deloitte, 2009). Like discussed earlier, in the multipolar world business will be done globally but there will be local nuances. This seems to be especially true in food and consumer goods business. Furthermore, it might be challenging for the Finnish companies to understand the nuances when they are entering new markets.

The multipolarization of the consumer goods industry is not only due to the different likes in different locations but also due to the different demographic issues. Consumers in low GDP countries are generally younger than the consumers in high GDP growth countries. This will further increase the gap between the needs of the developing countries and the post-industrialized countries. When the different needs in different countries are combined with the increasing cost of transportation, the goods will likely be produced as closed to the consumers as possible (Deloitte, 2009).

Different likes are not the only challenge Finnish industry is going to face in the emerging markets. Competition for the emerging markets will be very fierce. Emerging markets are especially important for the US companies. The domestic consumption in the USA was based on the lending before the mortgage crisis in the early 21st century. Currently, the consumers are decreasing their consumption due to the increased need for savings. Deloitte study states that the economic growth, in countries which were struck by the mortgage bubble, is based mainly on the export to BRIC countries and to domestic investments (Deloitte, 2011). Thus, big companies, which are suffering from the molten domestic demand, will compete more aggressively from the emerging markets.

Competition for resources

The competition for the resources is essential in food industry development. Biofuels and food production are dependent on the same resources, i.e. land, water and energy. The rising demand for the biofuels has peaked the commodity prices and caused food and fuel shortages (Pimentel, et al., 2008). Furthermore, as there will be billions of new people in the future, the food industry will face tremendous challenges to feed the population. In addition to the increasing population, the

consumers are also changing their diets from carbohydrate dominated to protein dominated ones. Failures to increase the food production might cause regional crisis and instability (European Environment Agency, 2011).

Decreasing resources

Like discussed earlier, competition for the resources in the food industry will be intensified in the next decades. The only problem for the raw material supply is not only the competition for the resources but their decreasing size. This is the case for example in the freshwater resources. Increased demand for the food has increased the demand for the freshwater. At the same time, the increased global warming has increased the evaporation which had further decreased the freshwater resources. The scene for the food industry seems very challenging – the demand will sky rocket but the circumstances for the production will be globally worsening.

When considering the future hard times for the food industry, Finnish food industry might have good circumstances to succeed in the competition. Firstly, there are large freshwater resources in Finland which the food industry could utilize. Secondly, the climate change could have temporarily positive effects on the Finnish agriculture. If the industry manages to brand their products as clean, safe and individual, companies have potential to grow their market shares.

In the commerce industry the effect of the decreasing resources is not as obvious as in the food industry. An interesting study evaluates the correlation between the consumer habits and the commodity prices (Deloitte, 2009). The study states that when consumers are expecting the commodity prices to increase, they will be more careful in long term consumption decisions. Like discussed earlier, the decreasing commodity prices are likely to increase the prices and thus according to the study to increase the volatility in the consumer goods markets.

Climate change and pollution load

Climate change could have positive effect on the Finnish food industry in the short run (Finnish Environment Institute, Aalto University, Finnish Meteorological Institute). Furthermore, Finnish food industry has access to the sufficient and clean raw materials resources, such as freshwater (Hyrylä, 2012). In the warning world, these issues could be a more important source of competitive advantage in the future. Especially freshwater resources could be limiting the food production in the future.

In addition to the practical aspects of the climate change, there are also several issues related to the consumer behavior. Compared with industries that manufacture investment goods, consumer behavior has more direct influence on the food and consumer good business. Future consumers will value based shoppers who want their values to be presented in the purchased products. For example, the awareness of the climate change could boost the markets for sustainable products. Sustainable products would be eco-friendly and they would be manufactured in an ethical way. I regard the increased demand for sustainable products important for Finnish food and commerce industry. Industries might benefit if they are able to communicate industries' sustainable ways of working to consumers.

Eco-friendliness could also affect unit sizes in the commerce business. Environmental aware customers would like to have their products packed in a recycled packing and the packing sizes could be smaller in order to minimize the over-consumption (Deloitte, 2011). Despite the need to reduce the overuse, transportation might be increased due to the smaller packings. This might eliminate the environmental benefit. If the environmental affect of the purchasing decisions was difficult to predict, the business influence would be even more difficult

Political

The market regulation is supposed to correlate with the productivity growth in the retail sector. A study indicating the correlation is shown in Figure 31. As we can see from the figure, the more regulated the market is, the smaller the productivity is (Ernst & Young, 2010). Several stakeholders are looking for less regulated markets in the future, and thus the probability of less regulated markets is higher than the probability of more strictly regulated markets. In addition, the less regulation there is in the domestic markets, the better companies are likely to succeed also in the emerging markets.

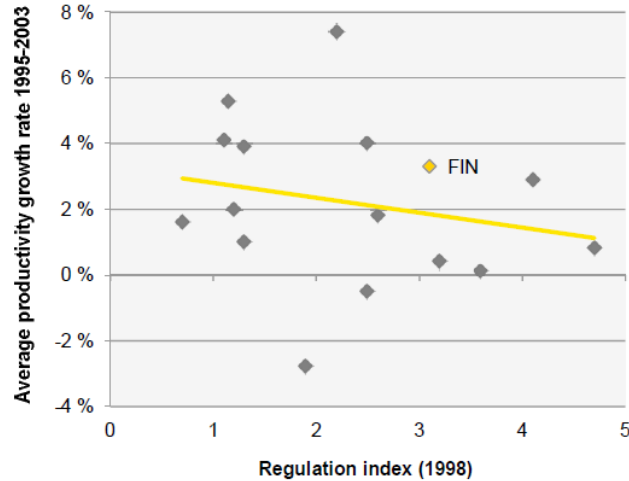


Figure 31 Effect of regulation in the productivity in retail sector. (Ernst & Young, 2010)

It is also highlighted that the legislation will be an important determinant in the diffusion of the mobile payments (Nurmi, Vähätalo, Saarimaa, & Heinonen, Ubitrendit 2020: Tulevaisuuden ubiteknologiat, 2012). If the legislation supported early the mobile payments, the Finnish commerce industry could gain a head start compared with the competitors. The increase of the mobile payments is just one example of the increased flexibility in the consumer goods markets. The flexibility is also required in the society where the NGOs and other non-governmental organizations have more power. Companies need to cooperate with increasing amount of different actors. In addition, the consumers will be more value biased in their purchasing behavior. The flexibility is thus needed to survive the market regulatory but also to serve customers.

3.6.4 Industry summary and shipping requirements

Based on the previous analysis about the Finnish consumer trade and food industry I have concluded possible statements about the industry development.

Statement 1: Consumer trade will become more complex in the future. There are not only different ways to purchase and deliver the goods but there are also diversified reasons for the purchasing behavior. Consumers want the purchased products to represent their values.

Statement 2: Market potential for the commerce industry will grow remarkable in the future as GDP in emerging markets increase. In the global scale small Finnish companies will face fierce concurrence in emerging markets.

Statement 3 Food demand in Finland has been very constant over time and there are not major drives visible that would change this. The increasing individualisms in diets will be supplied both from domestic and foreign supply. The Finnish food industry might benefit from the rising awareness of environmental, ethical and health issues but due to the costs and demanding transportation challenges the production could be moved closer to customers.

Commerce sector cargo can be characterized by the large number of different items. The variety of cargo is still expected to increase in the future due to the more individualistic consumption and improved technology which enables new methods to consume. As new methods to consume emerge, the transportation industry needs to find new procedures to combine the flexibility with benefits of scale. In a shorter run, commerce industry's import intensiveness might relieve some of the transportation industry problems. Vessel utilization could be remarkable improved if the same vessel could be used to transport both bulky material but also parcel goods.

New transportation business models were needed in the technology industry. The same statement is valid from the commerce industry point of view. In the future, it is not enough to have a superb commercial business model but companies should also have first-class operations to succeed in the business. Transportation companies, including ship operators and owners, which have open-minded business models have thus good changes to succeed in renewing markets.

4 Conclusions and summary

I have discussed megatrends and some industry trends in the previous chapters. Based on the analysis, it seems that the Finnish export in 2025 will be more diversified than nowadays. The relative share of pulp and paper products in the Finnish export is expected to decline whereas the mining sector will increase exports. Furthermore, the Finnish industry is expected to be more focused on the niche products whereas the mass products are expected to be manufactured abroad. The niche products will combine technologies from different branches.

4.1 Export outlook

Another matter to affect the industry is the multipolarization. Like I have discussed in Chapter 2.3.7, the export/GDP share is one measure to indicate the increased dependence on the global markets. The following picture depicts the export/GDP share in Finland between 1975 and 2011. The figure is based on the Finnish Customs data of the export and import. As one can see, the Finnish economy is more dependent on the foreign trade nowadays than before. There have been variations due to the economic crisis but trendlines show a constant increase over time. The trendlines are depicted in solid black lines in the figure.

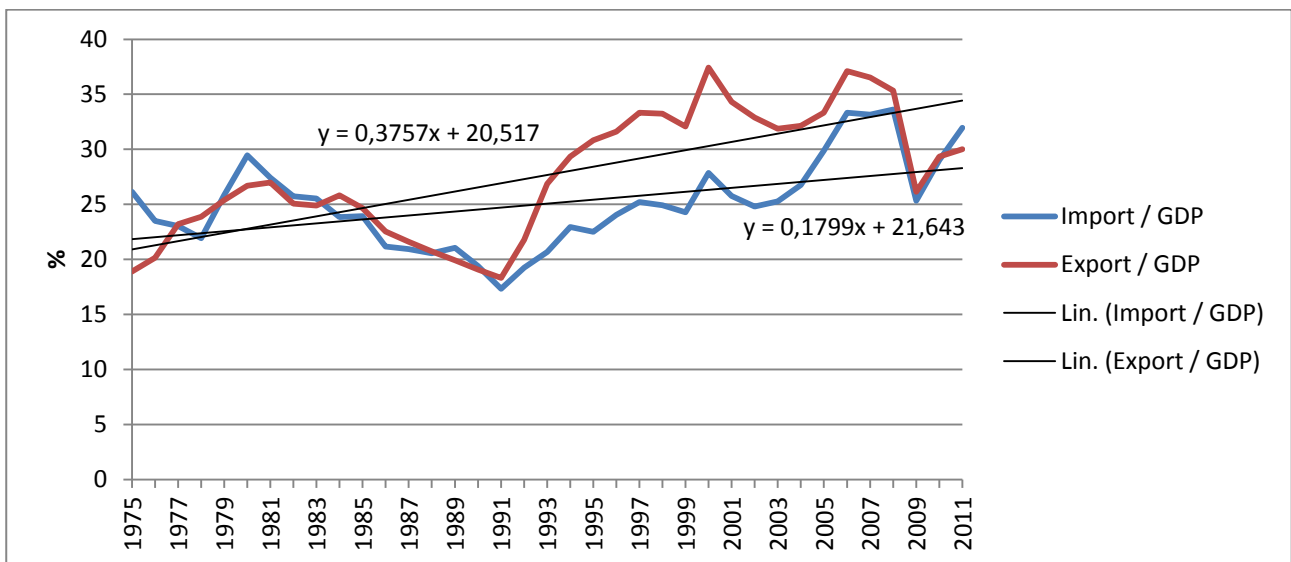


Figure 32 Relative export and import 1975-2011

The trend depicted in Figure 32 is expected to be valid also in the future. Due to the multipolarization, the Finnish economy will be more dependent on the foreign trade in the coming years. Thus, the linear correlations between the yearly change in the export and import of GDP could be used to evaluate the export and import in 2025. To do this, I have marked assumptions in

Table 4. The GDP growth is expected to be moderate 1.5 % a year. The 2011 GDP, import and export values are also shown in the table.

Table 4 Assumptions

2011		
GDP Growth	1.5	%
GDP	189.4	Billion €
Export	56.86	Billion €
Import	60.53	Billion €

Based on the 1.5 % yearly growth, the GDP is expected to be approximately 233 billion Euros in 2025. Furthermore, if the share of the foreign trade increase as expected, the net value of export will be approximately 40 % of the GDP in 2025. The ratio between import and GDP is estimated to be approximately 30 %. These values are calculated with equations

$$e = 0.3757x + 20.517$$

$$i = 0.1799x + 21.643,$$

where e is the export/GDP share, i is the import/GDP share and x is the difference between the analyzed year and 1975. The value of export and import would thus be approximately 92 billion Euros and 72 billion Euros respectively.

Table 5 GDP, export and import in 2025 (in 2011 Euros)

2025		
GDP	233	Billion €
Export / GDP	39.3	%
Import / GDP	30.6	%
Export	91.7	Billion €
Import	71.5	Billion €

To have a better view of the export in 2025, I have analyzed the industry development based on the analysis in Chapter 3. The growth rates are based both on the industry estimates but also on writer's estimate for the industry development. The current share of the industry is based on the Finnish Customs statistics. As it can be seen in the table, five industries shown in the table account for 91.5 % of the Finnish exports in 2011. The total share of these industries is 52 billion Euros. Based on the estimated growth rates, the described industries will export products worth 45-67 billion

Euros in 2025. If we estimate the total GDP to be 233 billion Euros in 2025, the total export of five industries will be approximately 20-29 % of the total GDP.

Table 6 Industry development

Industry overview	Growth rate (%)		Multiplier		Current share		Estimated export	
	Min	Max	Min	Max	%	milj. €	Min milj. €	Max milj. €
Metals and mining	3	15	1.51	7.08	0.7	382	577	4 083
Chemical industry	1	3	1.15	1.51	16.3	9 255	10 638	16 091
Forest, pulp and paper	-5	-1	0.49	0.87	19.7	11 187	5 456	4 740
Technology	-1	3	0.87	1.51	41.4	23 537	20 447	30 928
Commerce	1	2	1.15	1.32	13.5	7 684	8 833	11 655
SUM					91.5	52 044	45 951	67 497
% of GDP							19.7	28.9

When comparing the results in Table 5 and Table 6, one can notice that the total share of the five industries is only 20-30 % of the total export, whereas Table 5 expects the share of the export to be nearly 40 %. One reason for the difference could be the increasing importance of the services and non-material export. It is expected that in the post industrialized society, the importance of the services and ICT will be increased. This could explain the gap in the results.

Furthermore, the weighted growth rate for five industries will be 1.9 % annually in the best scenario. An EU based study has estimated that the maritime cargo volumes will grow 1.3 % annually until 2030 in the Baltic Sea (Baltic Transport Outlook, 2011). The same study estimates the Finnish seaborne cargo to increase 1.2 % annually. Thus, the growth of 1.9 % seems to be very feasible because the monetary value of the Finnish export is expected to increase more than the volume. The monetary value of the export will be increased due to the fact that the Finnish industry is expected to focus on the high value added products instead of the bulky products in the future. Additionally, the inflation increases the monetary values more than the real values. The most negative scenario corresponds to the annual growth rate of -1.1 %.

4.2 Vessel requirements

What would then be the most cost efficient way to react to the changing transportation requirements? Like discussed in the thesis, future markets will be more volatile and product cycles will be shorter than before. During the 40 years life cycle of the ship, transportation requirements might be changed many times. Agile transportation capacity is also needed due to the niche market products. Hence, it seems that vessels that are capable of carrying different cargo types might fulfill the industry needs best in 2025.

The flexibility of vessel transportation is also highlighted in other studies. A study funded by the Finnish foundation for the ship-owners states that the flexibility is the key-success factor for the ship transportation. It is highlighted that in the markets where lot sizes are decreasing and the volatility is increasing, vessels that are able to shift from one type cargo to other, are the ones to succeed. (Andrésen & Koshelev, 2012)

Table 7 shows cost estimates for different vessels types in 2011 and 2015. Vessel operation costs will be increased remarkable in 2015 due to the increased environmental legislation, more precisely due to the MARPOL Annex VI. All vessel types shown in the table are able to carry different cargo and thus meet the future shipping requirements.

Table 7 Cost effect of MARPOL Annex VI (Wahlström, Kajander, & Söderholm, 2013)

Vessel type	Consumption/vessel 2011 (tonnes)	Cost/vessel 2011 (€)	Cost/vessel 2015 (€)	Cost difference (€)
Ro-Ro passenger ship	11783	5 918 346	8 195 688	2 277 342
Ro-Ro cargo ship	6173	3 100 369	4 293 371	1 193 002
Container ship	2718	1 365 161	1 890 467	525 305
Other general cargo ship	710	356 466	493 632	137 166

As one can see from the table, MARPOL Annex VI increases especially costs of Ro-Ro ships. Container ship costs will also be increased by nearly 40 %. It seems that low consumption other general cargo ships will be the most cost efficient ship type in the future. However, it should be remembered that Ro-Ro ships operate very often in liner traffic where the timetable determines the vessel speed. Thus, the consumption cannot be fully optimized. In contrast to liner traffic, the vessel speed could be adjusted more in charter transportation to achieve lower fuel consumption.

Vessel design issues are undoubtedly crucial for the shipping industry development, especially if the development is observed from the ship-owner or vessel designer point of view. Ship designing issues are, however, very narrow sector when considering the overall development of the shipping industry. To take a giant leap instead of small steps, ship operators should pay more attention to alternative business models.

Currently, connections between manufacturing companies and ship-operators are very traditional. Many manufacturing company sees ship operators as suppliers of a standard service, i.e. transportation between point A and B, which should be provided as cheap as possible. From the transportation company point of view, manufacturing companies are customers who should be

served as cheap as possible but still not compromising the adequate operational margin. Hence the incentives of manufacturing companies and transportation companies might be conflicting. Furthermore, are manufacturing companies really the customers of the transportation company? In fact they are not. After all, customers are companies which have purchased the product of the manufacturing company. It matters to these customers if the transportation is late or the product is damaged in the transportation.

Thus I consider that the most developing potential would be in the business model development in the shipping industry. First steps to improve the ship transportation service would be the common definition of the customer and alignment of the incentives. Transportation should be seen as an extension to the manufacturing chain, which would add value to the purchaser of the product. As it was discussed earlier, high-value niche products with adjustable and on-time deliveries will be more important for the Finnish manufacturing industry. Therefore, there would definitely be markets for new transportation services within manufacturing companies who would like to differentiate themselves and provide higher value to their customers.

4.3 Summary

In this thesis I have studied future shipping requirements in Finland in 2025. The study is based on the megatrend analysis and industry outlooks of five different sectors – metal and mining industry, chemical industry, forest industry, technological industry and the commerce sector. A top-down methodology is used to generate data to support the strategic decision making when deciding vessel investments. According to the thesis, there are four crucial megatrends that will affect the future shipping requirements. First of all, the economic and social focus will be moved to emerging countries in the future. Currently emerging countries will be economic drivers of the future. Meanwhile the economic focus will be shifted to emerging countries, the world will be multipolarized. In the multipolarized world, countries and companies are more dependent on each other than before. Despite the global interconnection, local cultural differences will remain large in the future. Thirdly, the future development will be conditioned by the megatrend of “speed-up.” In the future new technologies will emerge quicker but last for a shorter period of time. Hence, the transportation capacity needs to be more agile. Lastly, megatrends associated with the environmental awareness will be more crucial for the transportation industry development. Environmental legislation and guidelines will set the framework for the future shipping industry.

On the industry level, different industries will have different transportation requirements. Ongoing structural change in the pulp and paper industry will cut down industry transportation volumes. On

the other hand mining and chemical industry have invested outstandingly in the production capacity in Finland. Especially, the mining industry cargo is forecasted to compensate the diminishing volumes in certain sectors. Investments are crucial when estimating the future cargo volumes. Companies investing today in new manufacturing capacity are the ones which require the most transportation capacity in the future. Another matter that would affect the export contribution of different industries is industry's operational focus in Finland. Some industries are investing in production capacity whereas others in R&D and supporting functions. It should be noted that investments in R&D and supporting functions do not necessarily mean higher export values in Finland. Furthermore, it can be seen that several industries position themselves in the high-quality niche markets in the future. Despite the niche markets would be global volumes might be lower than in bulky products.

The thesis focused mainly on the development of dry bulk export cargo. In order to maintain a more comprehensive view of the industry development, the import cargo should be analyzed. Cost of seaborne cargo could be reduced when the capacity is fully utilized during the trip out and in. Moreover, the transportation requirement analysis should be expanded to liquid bulk cargo. Especially, the importance of the chemical industry investments and the oil transportation volumes should be estimated to gain an overview of the future liquid bulk transportation requirements. It was discovered in the thesis that multipurpose vessel would be the most optimal design to meet the requirements of the Finnish industry. Vessel design optimization is not, however, the only thing companies can do to develop the maritime transportation industry. More crucial are new business models which would serve the future Finnish export industry. Research on alternative business models in the maritime transportation is thus required.

As concluding remarks it could be said that the future vessel should have the ability to carry different cargo types and it should be energy-efficient. The optimal vessel type choice, however, depends on the vessel operation model. In the liner traffic requirements are different than in the charter transportation. Furthermore, the maritime transportation companies should also pay attention to the new business models when serving the Finnish manufacturing industry.

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