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Competitiveness of the Finnish pharmaceutical industry

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Abstract

The pharmaceutical business can be considered a highly profitable business which generates the highest added value to the persons employed. The industry also employs four times more workers indirectly than directly. Having an increasingly competitive pharmaceutical industry would be beneficial to a nation. The main objective of this study was to determine the current state of the competitiveness of the Finnish pharmaceutical industry. Similar research was conducted in 1994. Another objective was to compare the results to the 1994 study and see what had changed in 25 years.

The competitiveness of the Finnish pharmaceutical industry was studied through Michael Porter's diamond model. The same model was also used in 1994. Another task was to determine the strengths, weaknesses, opportunities and threats of the Finnish pharmaceutical industry. The SWOT- analysis method was utilized for that purpose.

The study itself had a qualitative research approach. The data was collected from multiple sources. Secondary data was collected from books, internet articles, internet publications and governmental websites. Primary data was collected by using interviews. The interviewees were experts that worked in important roles in the industry.

In the year 1994, Finland had two major pharmaceutical companies. In 2019, there is only one left although the conditions for the industry to operate were good in 1994, and although they are still good in 2019. The infrastructure supports the industry, and the people working in it are well educated. However, the funding of startups could be improved.

Developing pharmaceuticals is very expensive, and further research is recommended on how governmental resources to support the industry could be increased.

Keywords/tags (subjects)
Pharmaceutical industry, Finland, Competitiveness,

Miscellaneous (Confidential information)

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List of ABBREVATIONS

API- Active pharmaceutical ingredient

EFPIA- European federation of pharmaceutical industries and associations

EFTA- European free trade association

EMA- European medicines agency

ETLA – The research institute of the Finnish economy

EU- European union

European community – predecessor of European Union (EU)

GMP- Good manufacturing practices

HILA- the price committee of pharmaceuticals in Finland

OTC medicine- Over the counter medicine

R&D- Research and development

STM- Finnish social and health ministry

SWOT analysis- Analysis of strengths, weaknesses, opportunities and threats

TEKES- The development center of technology in Finland

1 Introduction

1.1 Background of the study

In the year 1994, the Research Institute of Finnish Economy made a study about the competitive advantage of Finnish pharmaceutical industry. This study was one part of a larger study where the competitive advantage of Finland was researched throughout the major export industries in Finland. The purpose was to find which industries would have best possibilities of success in Finland. In this particular study, the Research Institute of Finnish Economy (ETLA) analyzed which factors affected the competitiveness of the Finnish pharmaceutical industry and characteristics in this field. The theoretical framework was based on Michael Porter's diamond model. The diamond model was developed in Porter's book called 'The competitive Advantage of Nations'. ETLA also managed to obtain valuable information from top level management of two leading Finnish pharmaceutical companies and from a professor at The University of Helsinki. (Laihonsalo 1994.)

The pharmaceutical industry as a concept can include various products. These products can be medical devices, rehabilitation devices, disability devices, active substances of medicines and fully made medicines. In ETLA's research on the competitive advantage of the Finnish pharmaceutical industry, the focus was on fully made medicines and active substances of medicines. (ibid. 1994.)

According to EFPIA's (European federation of pharmaceutical industries and associations) report called 'The Pharmaceutical Industry in Figures, the research-based pharmaceutical industry can play a critical role in safeguarding Europe's growth and ensuring future competitiveness in an advancing global economy. In 2017, the industry invested an estimated sum of 35 200 million € in R&D in Europe.

This number has grown significantly form the 1990s. The report states that in 1990, the R&D expenditure in Europe was 7 766 million €. The pharmaceutical industry is the sector with the highest ratio of R&D investment to net sales. The total pharmaceutical market value in Europe in 2017 was 207 000 million €. The R&D expenditure from that was 17%. The industry directly employs roughly 750 000 people and generates three to four times more employment indirectly than directly. It was also stated in the report that the pharmaceutical industry is a high-end technology sector with the highest added-value per person employed. It is significantly higher than the average value for high-tech and manufacturing industries. (EFPIA 2018)

In Finland, the pharmaceutical industry invested 198 million € in R&D in 2017, and it employed 4792 people. The total market value at ex-factory prices in 2017 was 2 333 million €. The R&D expenditure of this was about 8.5% (ibid. 2018). The Association of the Pharmaceutical Industry in Finland published a statement report in 2012 about what kind of an R&D environment for the pharmaceutical industry Finland was. In that report, the R&D expenditure in 2010 had been 227 million €, and the whole industry employed 5436 in 2011. Thus, both the R&D expenditure and the employment rates of the industry have decreased.

The industry itself is a high-end technology industry. It creates the highest added value to the employed persons and creates three to four times more employment indirectly. In addition, EFPIA sees that the pharmaceutical industry can play a significant role for Europe by ensuring future competitiveness in the advancing global economy (Ibid. 2018). If this is seen important for the industry in Europe, it could be an important industry to one nation, too. This study aimed to explore the current completive advantage of the Finnish pharmaceutical industry. By using Michael Porter's diamond model this study aimed to find that what has happened in twenty-five years and compare the results to Laihansalo's study.

1.2 The Purpose of this study

The purpose of this study was to explore the overall situation of the Finnish pharmaceutical industry and determine what had happened since the year 1994. In other words, the purpose was to examine which the major companies were, how they operated and how they had developed over the years. Michael Porter's diamond model was used when analyzing the competitiveness of the industry in Finland.

The results of this study are expected to benefit people and organizations who are interested in developing the pharmaceutical industry in Finland and make it more competitive in the global markets. This research was also a continuum to Laihonsalo's research in 1994, and it was hoped to act as a reference material for further studies.

The objective of this study was to describe the overall situation of the pharmaceutical industry in Finland as well as determine how the situation had changed since 1994 when Laihonsalo's reference study was made. The more accurate objectives were:

i. To form a good understanding of the pharmaceutical industry in Finland

ii. To research how the Finnish pharmaceutical industry was performing in the global markets

iii. To discover where industry was going and what the possible new opportunities would be.

The main focus of this study is on the pharmaceutical industry in Finland leaving out companies that market and manufacture medical devices, animal health products and free merchandise. The number of the companies and people in the industry are mentioned in order to provide the necessary information. This research will be fulfilled in year 2019.

This study sought to answer the following questions:

i. What are the strengths, weaknesses, opportunities and threats of the pharmaceutical industry in Finland?

ii. What is the competitiveness of the Finnish pharmaceutical industry?

iii. How has the Finnish pharmaceutical industry changed since Laihonsalo's study 'The competitive advantage of the Finnish pharmaceutical industry' published in 1994?

In order to answer the above questions, this study took an investigative approach. There was plenty of information available about the industry. With this method it was possible to use preexisting data effectively. The data was collected from articles, books, reports, interviews and other online sources. Michael Porter's diamond model was used as a tool for analyzing the competitiveness of the Finnish pharmaceutical industry. It was introduced in Porter's book "The Competitive Advantage of Nations". The book is based in Porter's international research on competitiveness, which studied over tens countries and over 100 industries. The diamond model helps to analyze how different factors affect the environment where the industry operates. A SWOT analysis was used to determine the strengths, weaknesses, opportunities and threats of the Finnish pharmaceutical industry. The result was compared to Laihonsalo's study results.

1.3 Structure of the study

This thesis consists of six main parts: Introduction, overview, literature review, methodology, results, discussion and conclusion. The Introduction chapter introduces the research subject. It tells why the study is important, what the objectives and the research questions are and what kind of data was used to collect the related information. The Overview chapter gives the readers a brief picture of the pharmaceutical industry in general. It also introduces the reader to the Finnish pharmaceutical market including the main companies and the history of the industry in Finland. The Literature review is based on Michael Porter's diamond model and

SWOT analysis. The Methodology chapter describes what kind of approach was used in this research. The results of the study are introduced in the fifth chapter. The final chapter includes the Discussion and results of the study. It also provides suggestions for further studies.

2 Overview

This chapter introduces the characteristics of the pharmaceutical industry in general. It also introduces the Finnish pharmaceutical market including the main companies and the history of the pharmaceutical industry in Finland. It also gives a brief picture of Finland, in other words, what kind of a country it is and its short history.

2.1 Finland

Finland is in the north of Europe. It is part of the Nordic countries and shares a border with Norway, Sweden and Russia. Finland is a sparsely populated country. Its surface area is 338 000 square kilometers, and the population is 5.5 million. In comparison, Poland's surface area is 312 000 square kilometers, and the population is 38 million. Finland became independent from Russia's rule on the 6th of December 1917. For a long time, the major industries were agriculture and forestry. Nowadays, the most important industries are forestry, metal, chemical, electronics and electrical industries. Finland joined the EU in 1995 and its currency is euro. (Europa 2019)

For a long time, Finland's economy prospered with regard to its trade balance because from 1990 for almost 20 years, the trade balance was positive. However, since 2010 the trade balance has been negative. As seen in Figure 1, nowadays Finland imports more than it exports. The main import and export countries are seen in Table 1.

Although the exports have decreased in the past years, Finland still is a well-developed modern country which performs well in the international economy and wellbeing ratings.

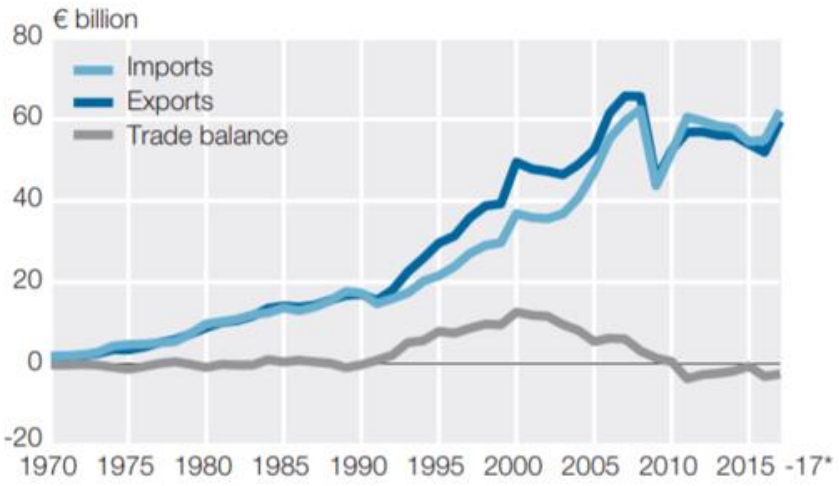


Figure 1: Imports, exports and trade balance of Finland, 1970- 2017.

Source: Statistics Finland (2018)

Table 1: Biggest import and export countries, 2017

Source: Statistics Finland (2018)

	Imports € million	%		Exports € million	%
Germany	9 612	15.5	Germany	8 484	14.2
Russia	8 201	13.2	Sweden	6 133	10.3
Sweden	6 849	11.0	Netherlands	4 103	6.9
China	4 560	7.3	United States	4 052	6.8
Netherlands	3 451	5.6	Russia	3 415	5.7
France	2 340	3.8	China	3 392	5.7
United States	1 935	3.1	United Kingdom	2 689	4.5
United Kingdom	1 830	2.9	Belgium	1 963	3.3
Poland	1 823	2.9	France	1 820	3.1
Estonia	1 823	2.9	Estonia	1 798	3.0
Other countries	19 628	31.6	Other countries	21 706	36.4
Total	**62 051**	**100**	**Total**	**59 554**	**100**

2.2 Introduction to the pharmaceutical industry

The Finnish Medicines Act, section 3, defines medicinal products as follows: . (Finlex 2019.)

Pharmaceutical medicines can be divided in originator products and generic products. Originators or innovators are the ones that have invented a particular active substance. The originator company has patented the molecule and has the exclusive right to market the product. The maximum validity time for a patent is 20 years. After the patent has expired, generic products start to come to the same market. The generic products are similar to the originator products. They have the same biological and therapeutic equivalency as the originator has, and they have the same form. Based on the documentation of the generic products, government officials will grant interchangeability status to the products. After that, pharmacies can change the physician's prescription from the originator product to generic product. (Pakkanen 2011.)

Many countries have a reimbursement system concerning pharmaceuticals. It means that the government reimburses a certain amount of the cost of the pharmaceutical to the patient. In order to attain the reimbursement status for a certain medicine, pharmaceutical companies must apply for it from the government officials. (Kela 2018.) At least in Finland, most of the pharmaceuticals that are sold through pharmacies are reimbursable. The reimbursement system is also one way for the government to control the pharmaceutical market. In Finland, the Price Committee of Pharmaceuticals (HILA) controls the reimbursed prices of medicines. They observe the prices and compare them to other counties. If HILA finds that the price of a certain product is much more expensive than it is in the reference countries, it will inform the company that they will have to lower their price. Otherwise, the product loses its reimbursement status. Some products are mainly used by hospitals, and companies do not apply for a reimbursement for these products because they are

paid by the government. In order to keep the costs in line, the government arranges hospital tenders.

In addition to prescription medicines, there are also OTC medicines. OTC medicines or over-the-counter medicines are products with a status of a pharmaceutical medicine, but they can be sold without a physician's prescription (Fimea 2019). In some countries, OTC medicines can be sold in grocery stores, but in Finland they are only sold in pharmacies. Nicotine replacement therapy products are an exception to this. They can also be sold in grocery stores.

2.2.1 Developing process of a pharmaceutical medicine

Before a pharmaceutical medicine is introduced to the market it must go through a long, thorough and expensive research process conducted by a pharmaceutical company. The average time from starting point of research to the point that the product enters the market is 12-13 years. In the year 2016 the cost of developing a new chemical or biological medicine was estimated be hundreds of million euros. In Efpias pharmaceutical industry in numbers it is mentioned that one to two of every 10 000 substances synthesized in laboratories will successfully pass all stages of development required to become a marketable medicine. In Figure 2 all the phases of the research and development process of pharmaceutical is explained. (Efpia 2019)

Former Orion's research and development director, neurology specialist professor Reijo Salonen explains r&d process in article of sic! -magazine. If everything seems to be ok and no problems have occurred in the pre-clinical stage the molecule can be transferred to next stage-clinical trials. At this stage the odds for making successful product out of the research molecule is couple of percent. However, this means that it is time start testing the molecule on humans. In phase 1 the molecule is tested with healthy voluntary subjects. In phase 2 the effect of the pharmaceutical is proven for the first time with patients. For the use of further studies, the possible dosage is

examined by balancing out the side effects and wanted effects. At this stage the probability of succeeding is 10-20%. Finally, in phase 3 the certainty of findings are confirmed usually in two different researches. These researches usually contain thousands of patients. These studies form the clinical foundation for the marketing authorization application. Roughly half of the molecules pass phase 3 and obtain the marketing authorization. (Salonen 2014) Sic! -magazine is produced by Fimea to bring information of pharmaceuticals to health care professionals.

Because of low success rate and high costs developing a new drug pharmaceutical companies have started to divide risk. Salonen writes in his article in 2014 that pharmaceutical research in now days is based on ever expanding co-operation. Pharmaceutical companies work together with universities and smaller companies to divide risk. (ibid.) This is also shown in the financial statement of Orion. Orion is developing a new pharmaceutical with Bayer. (Orion 2019)

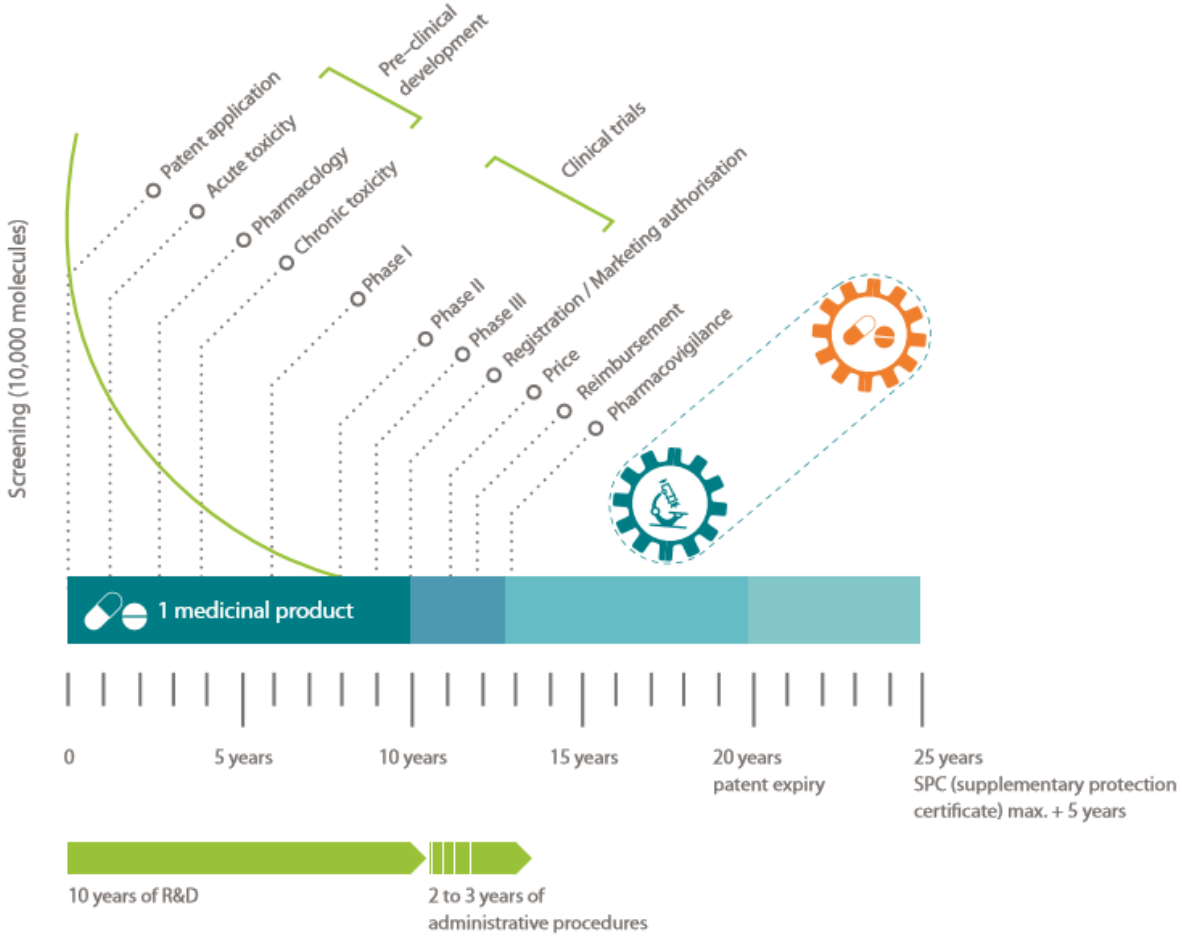


Figure 2: Phases of the research and development process of pharmaceuticals

Source: EFPIA (2019)

The research and development costs of Finnish pharmaceutical company Orion in year 2018 was 104 million euros according to company's financial statement. In the same statement their net sales were in year 2018 977 million €. It means that the company invested 10,6% of their net sales to R&D. If one compares Orion to one of the largest companies in pharmaceutical sector for example the swiss pharmaceutical company Roche had net sales of 39 400 million euros and invested 8 585 million euros to R&D in the year 2018 according to their financial statement. That is 21,7% of its annual net sales. In related to company's size it is more than half what Orion invested. (Orion 2019)

2.2.2 The Marketing authorization of pharmaceuticals

After the development process has successfully come to an end it is time to apply for the marketing authorization. To enter the market, it is mandatory for pharmaceuticals to have marketing authorization. The marketing authorization applications is based on documentation of the research and development process of the pharmaceutical product. Marketing authorization is granted by authorities, in Finland it is Fimea. For human medicine excluding herbal products there are four ways to apply marketing authorization in Finland. All this information can be found in Fimea's website. (Fimea 2019)

If the pharmaceutical product does not have marketing authorization in other EU-countries countries, Norway or Island, it can be applied just to Finland. This is called national procedure. The processing time of national procedure is 210 days. (ibid.)

In mutual recognition procedure, the marketing authorization granted in some EU country, Norway or Island is accepted also in other reference member state. For example, in Finland Fimea would accept marketing authorization of some pharmaceutical granted by Swedish authorities. The processing time of mutual recognition procedure is 90 days + 30 days to inspect the translations. (ibid.)

In decentralized procedure the marketing authorization is applied to several or all Eu-countries, Norway and Island at the same time. The applicant of the marketing authorization asks one member countries to act as a reference state. The reference state will make its own statement of the application. The other countries can give their comments to the refence states statement. If the application is approved it will also be approved in all Eu- countries, Norway and Island. The processing time of decentralized procedure is 210 days + 30 days to inspect the translations. (ibid.)

In centralized procedure the marketing authorization is applied to all Eu- countries, Norway and Island. In this procedure the marketing authorization applications is delivered straight to EMA office. EMA will handle to process as a whole. It is mandatory to use centralized procedure for all new biological medicine. The processing time of centralized procedure is 210 days + decision making time of EU's commission. (ibid.)

2.3 History of the Finnish pharmaceutical industry

The roots of Finnish pharmaceutical industry go at end of 1800 century and to the beginning of the 1900 century. It was time of technological and economic development which benefitted the start of pharmaceutical industry in Finland. In year 1914 the first world war started. The event stopped the import of foreign medicine. This was also a good opportunity for Finnish pharmaceutical industry to start manufacture medicine for its own citizens. First official pharmaceutical company was founded by Albin Koponen in 1899. Koponen was pharmacist in Nurmijärvi. He founded his company in alliance with his pharmacy. Albin Koponen's medical

laboratory manufactured pharmaceutical products for Finnish market. In addition, the products where imported to America and China. Koponen's factory was bought 1960 by Orion. (Joutsivuo & Parpola 2017, 15- 157.)

Today Orion is the biggest pharmaceutical company in Finland. It was founded in 1917 couple of months before Finland got its independence. Through various acquisitions Orion is today about a one-billion-euro company. According to company's Financial report its net sales in the year was 977 million euros. According to Laihosalo's research Orion's revenue in 1992 was 1 695,5 million Finnish marks. From that 651,2 million Finnish marks was from foreign activities. That is about 38,4% of total sales. (Joutisvuo & Parpola 2017)

In the research competitive advance of Finnish pharmaceutical industry Laihonsalo 1994 brings out four Finnish pharmaceutical companies: Orion corporation, Leiras, oy Pharmacal ab and Teria Berner lääketehdas (pharmaceutical factory) Oy. Teria Berner oy is still functional but it is not a pharmaceutical company and that's why Teria Berner oy will be ruled out from this study. Leiras was part of Huhtamäki corporation and in 1996 Huhtamäki sold Leiras to German company Shering. In year 1994 oy Pharmacal ab was owned by Orion corporation and Huhtamäki corporation 50/50. When Shering bought Leiras they gained 50% ownership from oy Pharmacal ab. So, in the year 1996 Orion was the only pharmaceutical company in Finland.

2.4 Finnish pharmaceutical industry in year 2019

From 1996 number of pharmaceutical companies has grown. Like mentioned before Orion Oyj is still the biggest company by far. Orion Oyj is publicly listed company and of the 977 million euros net sales 68% comes from foreign activities. In relation Orion has almost doubled the share of foreign activities within the company. Now days most of the revenue comes from abroad. Orion has its own sales network in Europe. Outside Europe Orion operates via partners. They say that Orion's products are being marketed in over 100 countries. Orion has its own raw material factory called Fermion. Fermion

is its own business unit and Orion says that almost 100% of its production is exported. Part of it exported straight and some part is exported in a form of readymade product by its mother company. Orion Oyj has its own made originator prescription medicine, generics and otc drugs and food supplements. It has also made sales and marketing deals to promote biosimilars. Orion Oyj invests to R&D about 10% of its annual net sales. According to company's financial statement from year 2018 the company has several ongoing research and development processes. In the year 2018 Orion employed 3179 people, 669 of that worked outside of Finland. (Orion 2018)

Oriola Oyj used to part of Orion Oyj. In 2006 Orion Oyj divided to Orion Oyj and Oriola-KD Oyj. After that Oriola has been a separate company from Orion. Oriola operates as wholesaler in Finland and in Sweden. It also has sales and marketing organization and it owns a pharmacy chain in Sweden. In 2016 Oriola completed the acquisition of Finnish dose dispensing company Pharmaservice and in the same year it bought a major share from a company Farenta. Farenta rents pharmacist to pharmacies. In sales and marketing Oriola is mainly focused in consumer care products and its main business is wholesale. From its 1552 million euro net sales in year 2018 the wholesale business contributed 1089 million euros. (Oriola 2019)

Verman Group Oy is according to their website a Finnish family company. They have a presence in Sweden, Denmark, Norway and Baltic countries. Verman is also present in China, Singapore and Russia. According to their website their one of the main focus areas is to strengthen their presses in Middle East and Asia. The whole groups net sales in the year 2016 was 36 million euros. According to pharmarket data their sales to Finnish pharmacies and hospitals in the year 2016 was about 27 million. So, most of the company's sales come from Finland. The company announces that their main focus areas of expertise is innovation, R&D, marketing and sales. More accurate information about their R&D was not available. Verman has 55 employees. Their current product variety includes generic prescription and OTC medicine and food supplements. (Verman 2019)

Vitabalans Oy develops, manufactures and markets generic prescription and OTC medicines. They operate in 14 European countries. According to company's website their turnover in the year 2017 was 29,3 million euros. The company has 210 employees of whom 70 works abroad. (Vitabalans 2019)

In addition to the companies mentioned before there is another set of companies in pharmaceutical industry Finland. These are not traditional sales and marketing firms. These firms manufacture and develop certain active substances. There is variation in the focus areas and some of them work as subcontractor in global market. For example Bioactive bone substitutes makes paste that can be used for treatment of bone defect and healing problems in extremities such as foot and ankle.(Bioactive 2019) Biovian Oy contract manufactures biopharmaceuticals covering services from early development to finished vial.(Biovian 2019) Fin vector vision therapies oy is a world leader in the research and development of viral-based gene therapy products.(Fin vector 2019) Galena Pharma Oy is pharmaceutical factory specializing in contract manufacturing and packaging services for pharmaceuticals and health products. (Galena pharma 2019) Pharmatory Oy company that provides GMP manufacturing of APIs and radiolabeling services and process R&D. (Pharmatory 2019) Syrinx bioanalytics oy offers a large variety of modern immunoassay techniques for bioanalysis of biologicals, biosimilars, immunogenicity testing and biomarkers. (Syrinx bioanalytics 2019) Metkinen Chemistry oy focuses on research and manufacture of indicators for RNA and DNA synthesis. (Metikinen chemistry 2019) Delsitech oy provides the technology and expertise for solving drug delivery problems. The company also has its own pipeline. The lead product is antiviral product for hepatitis B. The product will enter clinic in 2019. Forendo pharma oy develops drugs to clinical state. Their main focus is on specific hormone mechanisms and women's health. They call themselves a world leading innovator in the endometriosis fields and have two active programs in that field. (Forendo pharma 2019) Above information was gathered from the company's website.

Considering that Finland is small country there seem to be all sorts of pharmaceutical companies with in nations borders. Traditional sales and marketing companies, R&D and manufacturing companies and combinations of these.

2.5 Pharmaceutical market

According to the Efpia's report Pharmaceutical industry in numbers the worlds pharmaceutical market value was at 754 555 million $ at ex- factory prices in 2017. The north American market being the most significant with market share of 48,1% and Europe being the second largest market with 22,2% market share. Other markets can be seen in the Figure 3.

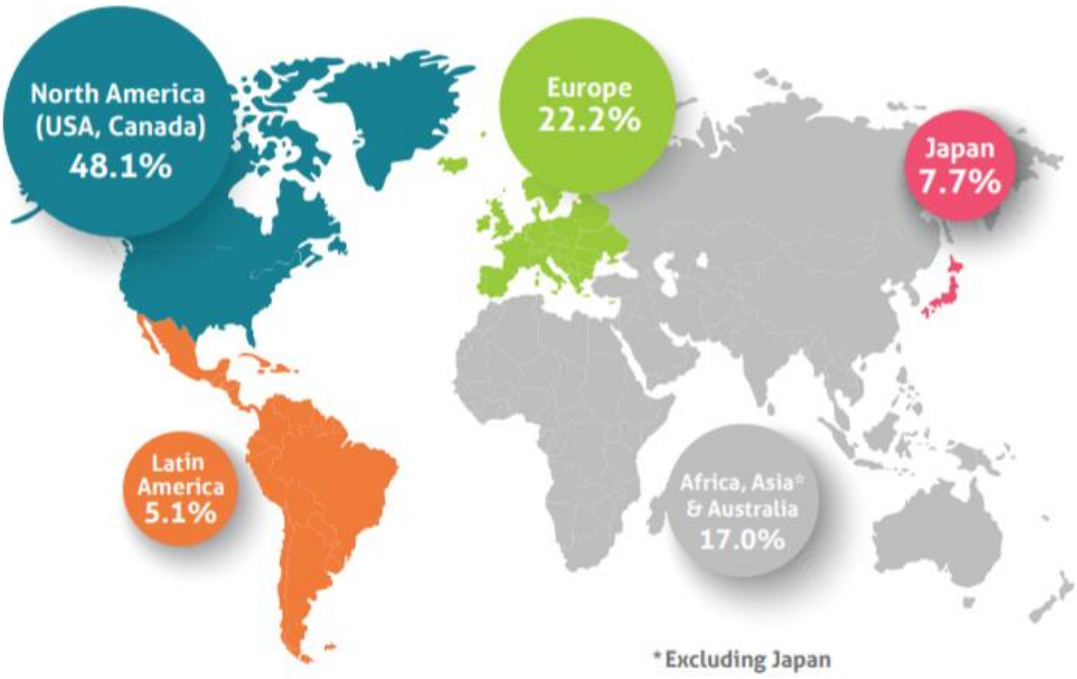


Figure 3: Breakdown of the world pharmaceutical market 2017

Source: EFPIA (2018)

If one compares the Finnish pharmaceutical market to global market, there are plenty of same companies in the top. (Table 2) The most significant pharma company in the world is Pfizer. According to its third quarter press release of the year 2018 they estimate to have an annual revenue of 53 to 53,7 billion dollars. (Pfizer 2019) In comparison the budget of Finland in US dollars is 61,76 billion. (Ministry of finance 2019) One difference in the Finnish market is that local company Orion is number in

the list. Orion's sales in 2018 was 1,1 billion dollars. (Orion 2019) The order of the companies in each market can be seen in Table 2.

The source of the Finnish market data is from Pharmarket. Pharmarket is commonly used source pharmaceutical sales statistics in Finland. The global data is from annual and financial reports of companies below. Some companies have also other sources of income than pharmaceuticals. This order is based on sales of pharmaceuticals.

Table 2: Top 10 largest pharmaceutical companies in Finnish and in global market

Source: Finnish data Pharmarket (2019). Global data annual and financial reports of above companies (2019).

	Finnish and global pharmaceutical market: TOP 10 largest companies		
	Finnish market in year 2018		**Global market in year 2018**
1	ORION PHARMA	1	PFIZER
2	MSD	2	NOVARTIS
3	SANOFI	3	ROCHE
4	ROCHE	4	JOHNSON & JOHNSON
5	PFIZER	5	MERCK & CO
6	RATIOPHARM(TEVA)	6	GLAXOSMITHKLINE
7	BAYER	7	SANOFI
8	GLAXOSMITHKLINE	8	ABBVIE
9	NOVARTIS	9	AMGEN
10	TAKEDA	10	GILEAD SCIENCES

When looking at the most significant products on page 19 every one of them is bigger than Finnish pharmaceutical market and one matter is common, all the products are biological medicine. According to Fimea biological medicine is a medicine that can contain one or several active substances. The substance must be from a biological origin or manufactured by biological source. Biological medicine has high molecular weight and their structure is more complex than chemically manufactured medicines structure. Because of the complexity of the structure and the way of manufacturing there might occur some natural variation between manufactured batches. Previously biological medicine was mainly developed to treat orphan deceases. However now days they are developed to treat more common deceases also like diabetes, arthritis,

bowel deceases, asthma and cancer. Experts believe that biological medicine have remarkable role in the future's pharmaceutical treatment because almost half of the pharmaceutical that are under development are biologicals. (FIMEA 2019)

Biological medicine are very expensive. For example, according to Kela's website the retail price of one injection bottle of Eylea is 1073,01€ and for Revlimid 25mg 21 tablet pack the retail price is 6171,88€. These prices were checked at 30.3.2019. Because of the high prices EU includes biosimilars to its legislation. Biosimilars are like generic medicine to biologicals. They are the cheaper option to originator product. However, biosimilars differ from normal generic drugs. Their marketing authorization requires much wider statements than just quality and bioequivalence studies. In addition to pharmaceutics and pharmacology the supervision is based on other lines of science like biochemistry, cell and molecule biology, micro biology, virology and immunology. (ibid.)

Table 3: Top 10 globally bestselling pharmaceutical products at ex-factory price in year 2017

Source: Igeahub (2018)

	Product name	**Active substance**	**Marketing company**	**Annual Sales**
1	Humira	adalimumab	Abbvie	16,41 billion €
2	Eylea	aflibercet	Bayer and Roche	7,33 billion €
3	Revlimid	lenalidomide	Celgene	7,29 billion €
4	Rituxan/Mabthera	rituximabi	Roche and Biogen	7,22 billion €
5	Enbrel	etaneresept	Amgen and Pfizer	7,11 billion €
6	Herceptin	Trastuzumab	Roche and Biogen	6,72 billion €
7	Eliquis	apixaban	Bristol meyers squibb and Pfizer	6,59 billion €
8	Avastin	bevacizumab	Roche and Biogen	6,42 billion €
9	Remicade	infliximab	Johnson & Johnson and Merc Co	6,38 billion €
10	Xarelto	rivaroxaban	Bayer and Johnson & Johnson	5,82 billion €

Depending on a biological medicine some are mainly hospital products, and some are sold via pharmacy. According to pharmarket data, in the Finnish pharmaceutical market 52,27% of the biggest selling biological medicine are to hospitals. This can be seen in Appendix 2. Like mentioned before hospitals acquire their medicine via tenders. Pharmaceutical companies set their bid prices of their products and most of

the cases the cheapest product is chosen to hospitals selection of products. However, if there is no competition in certain market of active substance, pharmaceutical companies do not have to give any discount and that generates a great deal of medicine costs to society. At least for now biosimilars bring a solution to this. When biosimilars enter the market the competition with pricing begins.

In the top selling products list of the Finnish pharmaceutical market there are mainly the same products that are in the global list. Seen on Table 3, similar issue to global market is that all of the products are biosimilars too. Noticeable in this table is that although Orion is the biggest company in Finland it does not have any products at top 10 list. In fact, the best Orion's product in the list is Burana. Burana is in the 16th place. The second-best product is Simvastatin Orion. That is on the 43rd place on the list. The order of 50 bestselling pharmaceuticals in Finnish market at year 2018 can be seen in appendix 1. Both Burana and Simvastatin are so called traditional medicine. Orion is the only Finnish pharmaceutical company who has managed to reach top 50 products with its products. (Pharmarket 2019)

Table 4: Top 10 bestselling pharmaceutical products at ex-factory prices, year 2018 at Finland

Source: Pharmarket (2019)

	Product name	**Active substance**	**Marketing company**	**Annual Sales**
1	Remicade	infliximab	MSD	57,49 million €
2	Humira	adalimumab	Abbvie	51,83 million €
3	Epclusa	sosfosbuvir/velpatasvir	Gilead	40,24 million €
4	Mabthera	rituximabi	Roche	34,74 million €
5	Revlimid	lenalidomide	Celgene	26,65 million €
6	Herceptin	trastuzumab	Roche	25,98 million €
7	Xtandi	entsalutamid	Astellas Pharma	25,90 million €
8	Enbrel	etaneresept	Pfizer	25,58 million €
9	Xarelto	rivaroxaban	Bayer	25,32 million €
10	Avastin	bevacizumab	Roche	24,34 million €

2.6 Changes in the pharmaceutical industry

A great deal has changed since 1994 in the pharmaceutical industry. One major change was when the generic substitution was introduced. In Finland, this happened in the year 2003. (STM 2018.) This meant that pharmacies could change medicines prescribed by a doctor or dentist to the cheapest or a cheaper product (FIMEA 2019). The purpose of this was to save costs. In most countries, the government subsidizes the reimbursement system of medicines, and thereby the government participates in the drug costs of its citizens. When pharmaceutical companies apply for a suitable price for their prescription medicine, they can also apply for a reimbursement. Hence, if the reimbursement is granted, the government then participates in the costs of the medicine. The amount of reimbursement varies between countries, and there can be different kinds of reimbursement categories. However, the point is that if the price of medicines becomes lower, it also lowers the reimbursement costs (STM 2002). According to the Association of the Finnish Pharmaceutical Industry, an innovator product's patent is valid for the maximum of 20 years. Thus, after twenty years, a pharmaceutical company could launch a cheaper and similar generic version of the innovator's product, and pharmacies could change the doctor's prescription to a cheaper option.

Another major change was the reference price system which was introduced in Finland in 2009 (ibid.). This was introduced because the Finnish government wanted to gain more savings from the pharmaceutical reimbursement costs. This meant that a prescribed substitutable medicine with the same active substance would form a price corridor. The price corridor was divided in two categories: under 20€ = 1.5€ price corridor and over 20€ = 2€ price corridor. It means that if a prescribed medicine cost under 20€, every substitutable product with the same active substance would have to have their prices within 1.5€ of each other. The cheapest product forms the price corridor, and the maximum reimbursed price is the price corridors maximum price. In Table 5 below this is explained. Product 1 is the cheapest, and it has formed the price corridor. The maximum reimbursed price is 11.50€. If the patient wants to buy the

most expensive product 6, the product will be reimbursed to 11.50€, and the rest is paid by the customer. Price corridors in the reference price system are formed four times a year. It has increased the price competition between pharmaceutical companies, and according to the Finnish economy newspaper Kauppalehti, the government savings of the generic substitution and reference price system between 2003 and 2018 were over 1 billion €. The reference price system has been brought to use in other countries as well. However, its characteristics might vary, but the purpose is the same.

Table 5: Explanation of price corridor

Source: Kela (2019)

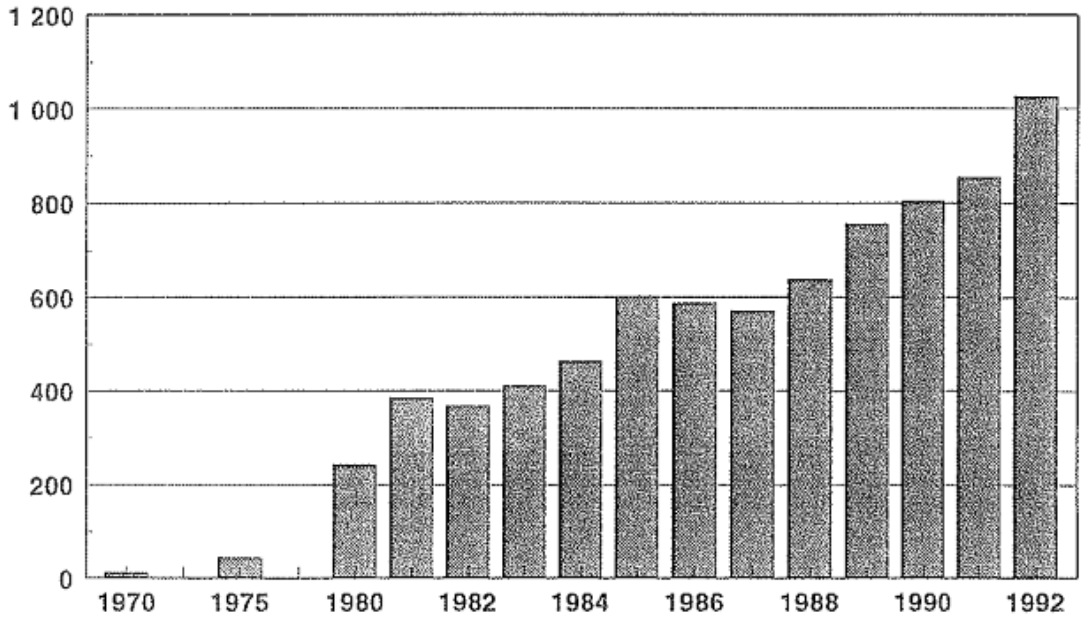
Price corridor 1,50€	**Price**	
Product 1	10,00 €	**Sets the price corridor**
Product 2	10,20 €	
Product 3	10,30 €	
Product 4	11,00 €	
Product 5	11,50 €	**Maximum reimbursed price**
Product 6	**15,00 €**	**Deductible to 11,50€**

2.7 The Import and Export of Finnish pharmaceuticals

In 1994, the export of pharmaceuticals was in strong growth. From 1970 to the year 1992, the export of pharmaceuticals had grown from 10 million Finnish marks to 1025 million Finnish marks. This development can be seen in Table 6. According to Laihonsalo, 50.4% of the exports was to the former European Community countries, 16% to America and 14.6% to the EFTA countries. The rest was exported to Asia and other European countries. The share of pharmaceutical medicine of the export was 74.1%. The rest was active substances and other export products. (Laihonsalo 1994.)

Table 6: Development of Finnish pharmaceutical industries exports in Finnish marks at 1970-1992

Source: Laihonsalo, 1994



In the twenty-first century, the exports of Finnish pharmaceuticals developed well until the year 2012. After 2012, the exports have decreased. In the year 2011, the exports of Finnish pharmaceuticals were about 1 150 million euros, and in the year 2018, they were about 740 million euros. The top fifteen exports and import countries are seen in Tables 8 and 9. All data regarding imports and exports was collected from the website of the Finnish Customs.

Table 7: The imports and exports of pharmaceuticals (SITC54) in Finland at 2002 – 2018 in euros.

Source: Finnish customs (2019).

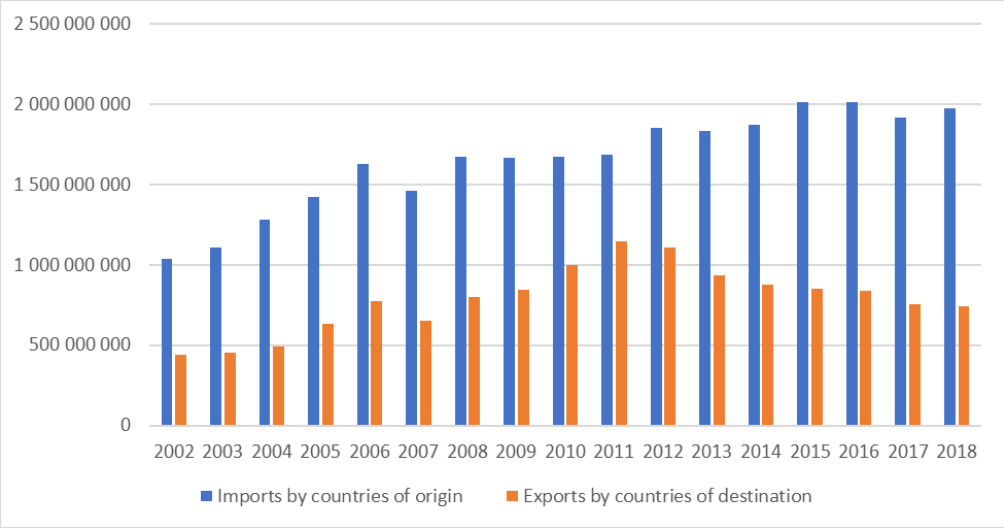


Table 8: Top 15 countries of pharmaceutical export from Finland at year 2018

Source: Finnish customs (2019)

Country	**Sum of Exports by countries of destination**	**% of total exports**
Belgium	94 316 151	12,77
Russia	80 291 687	10,87
Switzerland	79 656 605	10,78
USA	72 453 216	9,81
France	51 931 185	7,03
Sweden	44 634 879	6,04
China	28 639 994	3,88
Poland	24 554 362	3,32
Germany	24 111 099	3,26
Norway	23 516 232	3,18
Japan	23 164 694	3,14
Austria	15 213 703	2,06
Denmark	14 928 519	2,02
Ukraine	14 011 247	1,90
United Kingdom	9 592 698	1,30
Top 15 total exports	**601 016 271**	**81,35**
	738 794 947	

Table 9: Top 15 countries of pharmaceutical import in Finland at year 2018

Source: Finnish customs (2019)

Country	Sum of Imports by countries of origin	%of total imports
Germany	426 451 634	21,62
Denmark	211 771 314	10,74
Switzerland	174 595 976	8,85
USA	149 696 690	7,59
France	135 032 987	6,85
United Kingdom	114 170 350	5,79
Netherlands	107 627 999	5,46
Ireland	88 092 149	4,47
Sweden	82 807 168	4,20
Poland	82 043 766	4,16
Italy	59 712 745	3,03
Spain	53 792 289	2,73
Belgium	48 495 383	2,46
India	39 950 338	2,03
Austria	21 967 568	1,11
Top 15 total imports	**1 796 208 356**	**91,08**
Total imports	**1 972 122 529**	

3 Literature review

As Porter (1998) mentions, pharmaceutical industry is considered as one of the most profitable industries in the world. The biggest selling pharmaceuticals sell billions of euros annually and earlier in this paper it has been pointed out that according to Efpia the research- based pharmaceutical industry can play a critical role in restoring Europe to growth and ensuring future completeness in an advancing global economy. ETLA has researched of the competitiveness of Finnish pharmaceutical industry was published in 1994. Because of the importance of the subject the association of pharmaceutical industry in Finland made a statement in year 2012 about Finnish r&d and innovation environment of pharmaceutical industry. There has been plenty of changes in the industry and there is reason to research this subject again. To obtain a deeper look of this subject it is important to define competitiveness. For analyzing tool, Michael Porters diamond model will be used to dsicover the current state of the competitiveness of Finnish pharmaceutical industry. The whole industry will also be analyzed through SWOT. The factors are reviewed in the next chapters.

3.1 Competitiveness

According to world economic forum a competitive economy is a productive one. Productivity leads to growth which lead to raised income levels and improved well-being. (World economic forum, 2017)

Countries compete to develop. They compete for markets, for technology, for skills and investment. They compete to grow and raise their standards of living. In this competitive environment, governments try to create best possible environment that provides distinctive advantages to firms: high savings and low interest rates for investments, sound property rights and good governance, a technologically motivated and committed workforce and low rate inflation. (Vietor 2007, 1)

Depending on concept, competitiveness has different definitions. According to Michael Porter to companies it means to have ability to compete in the worlds market depending on your global strategy. Porter believes that the national environment has remarkable effect to companies' ability to compete. (Porter 1998, 25-26) Government has critical responsibilities for fundamentals like primary and secondary educations systems, basic national infrastructure and health care system. Although these are vital parts of functioning society these rarely produce competitive advantage. Competitive advantage needs more advanced actions. (Porter 1990)

In world economic forums report of global competitiveness (2018) it is said that competitiveness is not a zero- sum game. All countries can be more productive at same time. For example, if country X is able to improve the standards of education it does not lower the standards of education in other countries. (World economic forum 2018)

When analyzing competitiveness, the industry itself is the base of the analysis. The industry itself defines how profitable the business is. Strategy of the company must be based on the structure of the industry and to understanding its changes. According to Porter the characteristics of the competitiveness depends on five competitive factors. These factors can be seen in Figure 4 (Porter 1998, 71-72)

Figure 4: Five forces analysis of industries competitiveness

Source: Porter (1998)

The strength of these five forces vary between industries and they define the long-term profitability of the industry. That is because they have an effect to industries prices, costs and level of investment. The threat of new competition will limit profits because new competitors bring new capacity among themselves and they gain market share with lower prices. Influential customers have power to negotiate some of the profits to themselves. Hard competition will narrow down profits because the companies must put more effort to sales, marketing and r&d or/and companies have compete with lower prices. The existence similar products will also lower prices and sales volume of industry. (Porter 1998, 71-72)

The strength of these five factors depend on economic and technical features of the industry. For example, the bargaining power of the customers depend on the number of customers and the fact that how big part of the company's sales come from a one customer. It may also be a question of costs. If one product forms remarkable part of customers total costs they it raises the consciousness of prices. The threat of new competition depends on the barriers to enter the industry like

brand loyalty, structure of distribution, technological features and startup costs. (ibid. 71-72)

Sloman (2007) adds some more barriers in his book essentials of economics like economies of scale, legal protection, mergers and takeovers and aggressive tactics.

The threat of substitutes is high if the substitute product is cheaper, if switching costs are low, or if quality/performance is the same or better. Same principals can be used in the bargaining power of suppliers. For example, if the switching costs from one supplier to another are high or if there are only few suppliers the bargaining power of supplier are high. (Porter 1998, 71-72)

In addition to industries structure companies must position themselves inside the industry. The core of the positioning is competitive advantage. There are two types of positioning: low costs and differentiation. When a company has low cost structure it can manufacture and market its products more efficiently than its rivals. This will lead to higher profits. Differentiation means ability to offer unique or/and superior value to products quality, special features or after sales services. Because of differentiation companies can ask for higher price of their products. This will mean better profitability if cost structure of the company is comparable to its rivals.

To compete successfully in any line of business companies must define their strategy. The purpose of the strategy is to form competitive advantage. The basic strategies of competitiveness can be seen in Figure 5 and they are based on the positioning of the company. According to Porter (1998) there is not a superior strategy that is suitable for all industries. In many industries different companies can use different kind of strategies and still prosper. The most important issue according to Porter is that the company must choose the target area where it wants to compete and what kind of advantage it seeks. The worst mistake is to be in the middle and try to follow all the strategies simultaneously. That will lead to average strategy with below average results.

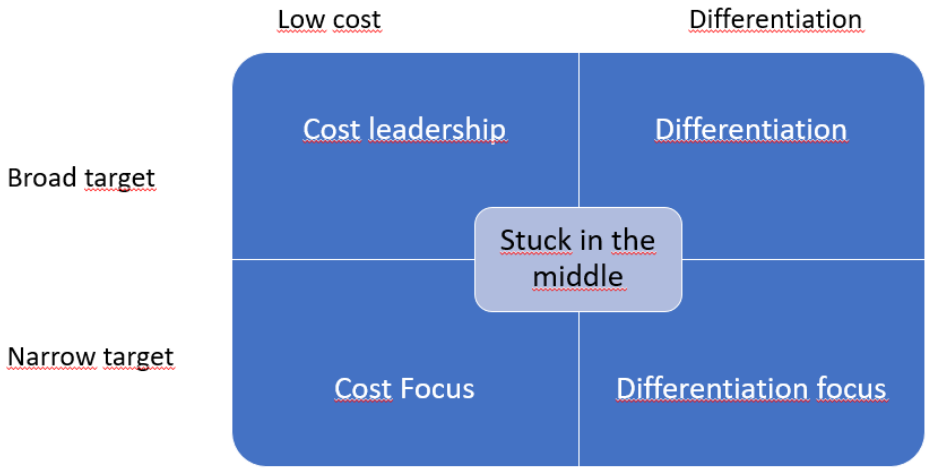


Figure 5: Basic strategies

Source: Porter (1998)

Companies create competitive advantage by innovating. They try to find and create new and better ways to compete. Innovations can be improvements in technology or methods and ways to operate. These can be changes in products, changes in processes, changes in distribution, new ways of marketing and finding new sectors where to operate. Innovations lead to changes concerning competitive advantage when rival companies do not react to the changes. It might be that rivals have not noticed these changes, or they are too satisfied or inflexible to do anything. It might also be a question of resources. For the challenger it is very important to find new ways of doing things. Otherwise it is very hard to challenge the leaders of the industry. Typical matters of creating competitive advantage are new technology, new or changing needs of customers, the birth of new segments inside industries, changes in key factors (labor, raw materials, energy, transportation, communication systems of machinery) costs or availability and changes in government laws or acts. (Porter 1998)

Industries competitive advantage must be based on factors that work well in the home country. Weather a certain strategy is easy to follow or not depends on the characteristics of the home country. Industry succeeds in countries where they are forced to see new ways to operate and countries succeed when they encourage

companies in early state to start using these new ways. Countries succeed in industries where there is sufficient pressure to conquer laziness and encourage to constant improvement and renewal. Success in the international competition requires that companies develop their international status based on their status on the home lands market. This will enable the possibility to depend on the benefits they have acquired in the home market and strengthen these benefits with the help of global strategy. Countries succeed in industries where their competitive advantage is valuable in other countries as well and it foreshadows the needs of international markets. Countries fail when companies do not receive the right messages and are not exposed to right kind of pressure. That means that the companies stop evolving. (Porter 1998, 112- 113)

The standard of living depends on productivity. So that the economy could grow it must evolve constantly. This requires constant improvement and innovation in the existing industries and also in the new industries. Nations need new businesses to create new productive jobs. (Ibid, 689) Porter also writes in that employment rate itself is not a very good indicator for productivity because it can be raised by employing plenty of people with low wages. The government should support businesses with its politics to this kind of dynamic evolving. The goal is to create a kind of environment where the existing industries can develop their operations with help of new technology and methods and also to operate in segments. This kind of environment will lead to higher productivity. (Ibid. 689)

To gain even more advanced competitive advantage in more advanced industries companies need more skilled personnel. The quality of human resources must evolve all time if target is economic growth. According to Porter countries (e.g. Germany and Japan) that put effort on education have advantage in many lines of industries. Government can influence in the long-term development of its industries by putting effort on education. That alone does quarantine competitive advantage. At the same time, it is important compound the governmental education to work life and encourage the companies to educate their staff. (Ibid. 701)

Economic growth also needs more advanced technology. Developing more advanced science and technology is known to be at government responsibility because the results benefit the whole nation. In addition, that it benefits companies, it also benefits the whole industry. Almost in every well-developed country has programs for developing new technology. Governments may also take part in direct research. For example, government funded universities co-operate with companies to develop new technology. In addition to develop science and technology, governments should also put effort on innovation. Although innovation includes science and technology it also developing new ways to compete (Ibid. 704)

Developing nations industries needs also modern and constantly developing infrastructure. This applies especially in transportation, logistics and communication. These are all vital parts when competing in international markets. Both companies and government have a duty to create and develop the infrastructure. Traditionally this has been governments job but now days privatization has entered to this sector and there are plenty of companies that have specialized to develop infrastructure. (ibid. 712)

Developing economy requires that there is enough available decently priced capital that can be invested through banks and investment markets to most profitable targets. Low interests encourage companies to invest more and this will lead to constant development. (ibid. 712)

Even with various resources no countries have successfully accelerated their economic growth without capital. In other words, if consumption and imports absorb all available resources, countries have too little surplus capital to invest in growth. (Vietor 2007, 13)

When industry succeeds the companies of the nation are also at risk losing their competitive advantage. When the nation has demanding customers, technical know-

how, professional work force and tough competition among accrued competitive advantages like brand reputation and stabilized global networks, companies can change, adapt and maintain their competitive advantage for decades. Disadvantages of factor conditions can be replaced by moving some vital functions to other countries. In long term this will weaker the factor conditions of a nation. (Porter 1998, 219)

3.2 Different stages of competitiveness

Different countries can be in different stages in their development. The stages also reflect to the sources of international competitiveness and define nations status in prone to international competitiveness. Porter says that the purpose of these stages is to reflect the main characteristics of the nation's industries and focus on those which are most important regarding economic prosperity. In every nation there are industries that have different kind sources to their competitiveness. Even in the most developed countries there are industries where the source of competitiveness is mainly natural resources. In this theory there are four stages: factor driven, investment driven, innovation driven and wealth driven stage. Economic prosperity is related to first three. The fourth stage usually means lack of actions which eventually leads to economical drop. These four stages can be seen in Figure 6. (Porter 1998, 612- 613)

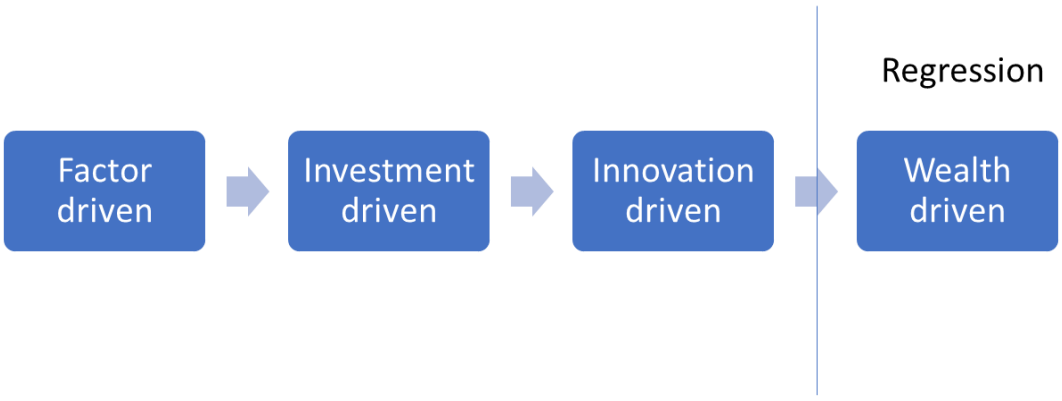


Figure 6: Four stages of nations competitive development

Source: Porter (1998)

In factor driven stage nations source of competitive advantage are basic factors of production: natural resources or cheap workforce. This will limit the segments where the nations industries can compete. These kinds of industries usually compete with price. The needed technic is acquired from other countries and it is very rare that the companies that operate in this stage have any kind of connection to the end users. In this stage the nation is sensitive to changes in worlds economy cycles and exchange rates.

In investment driven stage nations competitive advantage is based on willingness and ability of the companies to invest heavily. Companies build modern, efficient and big production plants where they use best available technology. They also strive to acquire complex foreign product and process technology with licenses and joint ventures. By doing this they are able to compete in more developed industries and segments. The difference between investment driven and innovation driven stages is in what companies do with the technology they have. Are they able to improve it themselves or do they invest to obtain the next version. Nations that are in this stage usually have products that are one generation behind of the world's leading products. In this stage the competitive advantage is based on improving factor conditions, strategy and structure of the companies. By doing this the basic costs for factory conditions become lower and companies have more capital to invest. The know-how of the employers is increasing but their wages are still quite low. The nations that are in this stage are developing their standard of living might still be modest. This means that depending on the industry demand of the home market is usually low. (Ibid. 613-619)

In innovation driven stage demand of the home market becomes more sophisticated because the income level of consumer is increasing, the level of education is evolving, the desire for comfort is increasing and the rivalry in home market tough. New businesses increase the level of competition which accelerates r&d actions and innovation. Competing with factor conditions becomes rare because success of the industries creates pressure to increase costs. Companies start to compete in more

differentiated segments. They are still competing with costs, but costs are not depended of factor conditions, they are depended on productivity which is a cause of new technology, skills and innovation. In innovation driven stage nations can tolerate better changes in global economy and the variation of exchange rates. That is because they compete with technology and differentiation. According to Porter Britain achieved innovation driven stage in the early 1800. United States, Germany and Sweden reached it about 1900 when Italy and Japan reached innovation driven stage in about 1970. (ibid. 620-623)

In wealth driven stage the power of economy is the achieved wealth. The problem is that the nation is not able to maintain its wealth. The companies start to lose their market share in the international markets. That is because they want to maintain their current position not improve it. Companies willingness to invest decreases. The willingness to innovate also decrease because the company is not willing to act against common norms and they tolerate poorly any kind of judgement. The employees lose their motivation because of the increased income level and at the same time their number of objectives expand. The productivity has a hard time to keep up with the increased wages. Foreign companies that have true competitive advantage start to acquire nations companies or they expand otherwise to the nations markets. When companies start to lose their competitive advantage, they start downsizing. Many companies will have hard time to cope and it will lead to redundancies. The level of income decreases and the demand of home market shrinks. Societal programs will exceed the solvency of the economy. The nation has to raise taxes to maintain its programs. (ibid. 623- 626)

3.3 Porters diamond model

To be able to measure competitiveness of a nation one must have proper theory to use. Michael Porter developed his diamond model for this purpose. Porters diamond model examines competitiveness of a nation through four main factors: factor conditions, demand conditions, related and supporting industries and firm strategy structure and rivalry. In addition, there two variable that have effect on the four factors: government and chance. The full diamond model can be seen in Figure 7. (ibid. 114)

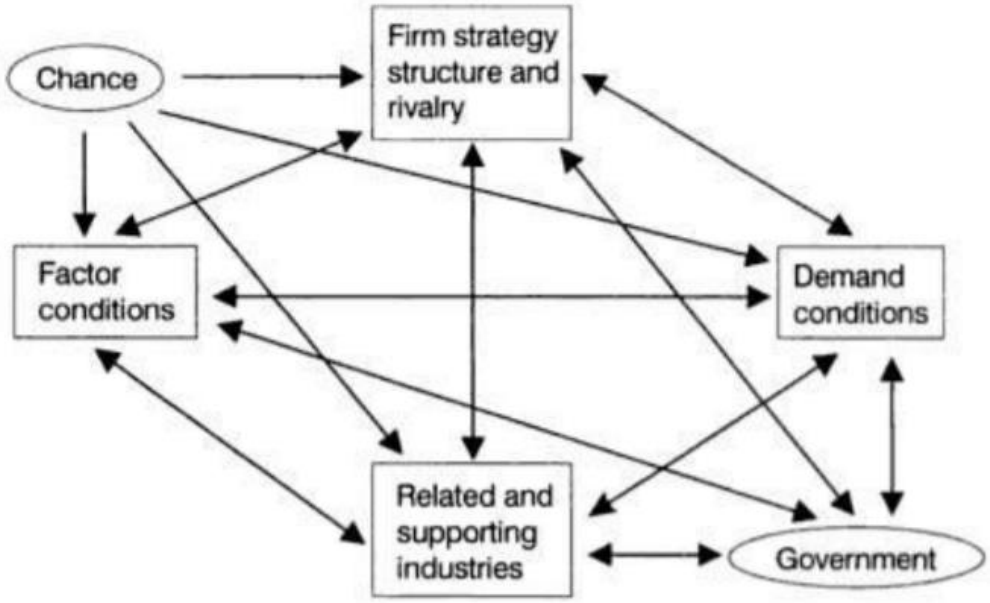


Figure 7: Michael Porters diamond model

Source: Porter (1998)

The diamond model is system where every factor strengthens each other. If the demand conditions of home market are favorable, it won't lead to competitive advantage unless the companies react to it. Consequently, these basic factors measure what kind of condition industry has in nation to compete internationally. (ibid. 116)

Dunning writes in his book the globalization of business that Michael Porter has rendered a very considerable service in identifying many of the explanatory variables which help us better appreciate some country specific explanations of the changing pattern of international production by multinational enterprises. In particular his extensive field research has advanced our knowledge of why corporation domiciled in some countries have been successful in penetrating foreign markets and but not in others. (Dunning 1993, 103-104)

3.3.1 Factor conditions

Every country has factor conditions in its disposal. Factor conditions are vital resources that are needed in competition between companies. Workforce, natural resources, farmland, capital and infrastructure are factor conditions. These conditions have a clear effect to the competitive advance of nation, but the biggest advantages are created not inherited. The nations that have created greater competitive advantage on factor conditions have put effort to creating, developing and specializing. The factor condition resources are not as important than how they are developed. In fact, the abundance of factor conditions may even cause disadvantage to competitiveness.

Factor conditions can be divided to five subgroups: Human resources, physical resources, knowledge resources, capital resources and infrastructure. Human resources include the quality, quantity, cost and working morale of personnel. Human resources can also be divided to different classes depending on the educations or tasks.

Physical resources contain: land, water, minerals, wood, water power, fishing conditions etc. and their quality, quantity, availability and costs. Climate conditions, geographical location and size can also consider as a physical resource. Proximity of

some economically important nation can be beneficial and also suitable time zone. It is much easier to do international business if companies can do it during normal working hours. (ibid. 117-120)

Knowledge resources are scientific, technical, product and services related market information. It can be retained in universities, public and private research centers, managerial and scientific literature, market research rapports and data bases. Knowledge resource can be divided to different subcategories depending on the subject e.g. mathematics and pharmaceutical research.

Capital resources are used in funding the investments of businesses. The total costs and available quantity are relevant. There are different kind of capital resources like uninsured debt, insured debt, stock capital and venture capital.

Infrastructure includes for example transportation systems, communications systems, post, payment transactions and health care. Infrastructure also includes housing and cultural institutes and facilities that have effect on quality of life and attractiveness of nation as place to work and live.

The effect of factor conditions to competitiveness depends on how efficiently they are used. Companies decisions about the use of factor conditions influence this. Almost every country has good sources of factor conditions on its possession which have used poorly, or they have not been used in right industries. Other factors of the diamond will be needed to explain, when with help of factor conditions, it is possible to reach competitive advantage. (Ibid. 118, 199)

3.3.2 Demand conditions

The second factor in creating competitive advantage of nation are demand conditions. The demand of the home nation can affect through economy of scale to static effectiveness, but much more effective effect is dynamism. It modifies the speed of improvement and innovations made by companies. The consistence, the extend and the growth of the demand are three important definitions. Also, the quality of the demand is more important than the quantity.

The demand of the home nations effects competitiveness the most through customers' needs and characters. The consistence of the demand has effect on how companies detect the needs of the customers and how do they interpret and react to them. Nations gain competitive advantage on those industries where companies are able to discover customers' needs in earlier than competitors. The customers of a home nations may even put pressure to companies to innovate faster and gain more advanced competitive advantage than foreign rivals. To be able to understand customers need, companies must become close to customers. It need open communication between company's management and technical staff. Even in the home market it is a hard task but in the international market it is even harder. (Ibid. 131-137)

The nature of the demand of home nations customers may lead to competitive advantage if customers belong to a worlds sophisticated and demanding class of buying certain types of products or services. Sophisticated and demanding customers put pressure on local companies to fulfill high standards in quality, features or maintenance. Also, if the customers of home nation have ability to anticipate the future needs of other nations, it can be used to gain competitive advantage. With the help of anticipation companies are encouraged to develop better new products and to compete in new segments. Tough home land demand boosts competitive advantage only when the anticipate the demand in other countries. If the tough

demand of customers regards only the home market, the demand will weaken the international competitiveness. (ibid. 131-137)

If the consistence of demand is well developed and it anticipates the future needs of other nations, then the extend and growth of home nations demand may strengthen the competitive advantage of home nation. Companies will gain benefit to economy of scale with help of large demand of home market. However, the extend of home nations demand can also been as a weakness because the small size of home market will force companies to expand their business to other countries. (ibid. 138)

3.3.3 Related and supporting industries

Presence of internationally competitive related and supporting industries is important concerning competitive advantage of nation. Competitive advantage of some related or supporting industries can create important contributions to other industries and help them innovate and improve their products and services. Programming is a good example of this. If supplier industries are internationally competitive the availability of better machinery, computer programs raw material, new technology etc. improves. With the help of these improved stakes companies can operate more efficiently and improve their productivity and profitability. Close relationship with internationally competitive suppliers can benefit companies with new innovations and knowledge. A significant competitive advantage of companies related industry may be a gateway to start operating in another industry. Porter gives an example that a strong coloring business helped Switzerland to reach strong success in pharmaceutical business. (Ibid. 147- 149)

3.3.4 Firm strategy, structure and rivalry

The habits of a nations effect on how companies are managed. The companies of nation are not the same, but effect of the surroundings will give the similar features. Differences in ways of how to manage companies concern the education of managers, their background and orientation, how much teamwork and hierarchy are implemented, the value of proactive individuals, the way of doing decisions, the nature of customer relationships, attitude against internationalization (e.g. language barrier) and relationship between workers and management. These differences will cause both benefits and disadvantages to companies. The way the companies are being organized and managed is affected by several country related aspects. The most important aspects are attitude against authorities, standards concerning interaction between people, the relationship between managers and workers, and the social standards concerning group behavior vs. individual behavior. These aspects are influenced by following factors: educational system, social and religious background and family structure.

There is a big difference between goals of companies in different nations. There also big difference in motivation of workers and managers. Nations will succeed in industries where goals and commissions are inline. Investments are also big part of success. Nations will usually succeed in industries where companies invest more than average. Also, the status of the industry has an effect on what sort of people the industry draws in. If a certain industry has very respected status in certain nation it draws in innovative and better educated people. The people who get in to the respected industry will most likely show great commitment and motivation towards their job. (Ibid. 155- 167)

Rivalry in home market will cause pressure to companies to innovate and improve their actions. The rivalry of local companies will force each other to lower costs, improve quality and services and develop new processes and products. Addition to

price competition is also taking place products quality, performance and service. When constant need of growth becomes harder to achieve in home market companies will seek new sales from abroad. If one company succeeds internationally it is signal to others that it is possible. This encourage other firms to go global also and it lure in new competition also. The quantity of rivals will not guarantee competitive advantage. On the other hand, the quality of rivals will give it a better chance. (ibid. 168- 169)

3.3.5 The role of chance

The four main factors of the diamond model will shape the environment where companies compete. In addition, many successful industries have had a little bit of luck also. Chance events does not affiliate to circumstances of the nations and government and companies are not able to influence them. Different kind of events or decisions cause an event of chance which help industry to gain competitive advantage for example: inventions, wars, discontinuity in global market (e.g. oil crisis), changes in decisions made by foreign governments and changes in global money and exchange market. Events of chance are important because they cause discontinuity which enables changes in competitive positions. Events of chance can make rivals competitive advantage invalid and create chances to new companies to gain competitive advantage. Event of chance may enable changes in industries competitive advantage, but nations characteristics will influence it which nation will be able use these new chances. Inventions are more likely to occur in place where certain industry has good circumstances to operate. These circumstances gather plenty of companies which operate in the same field and constantly tightening rivalry will force companies to innovate. Inventions may also occur in circumstances where the aspects of the diamond model is not that suitable for a certain industry. Porter gives an example that insulin was isolated first time in Canada but because circumstances to pharmaceutical industry were not that suitable, companies from Denmark and United States took the invention and made it a big business. This

happened because Denmark and United States had better circumstances for pharmaceutical industry to operate. (Ibid. 173- 176)

3.3.6 The role of government

The role of government can affect either positively or negatively to all aspects of the diamond. Effects on factor conditions can be influenced with supporting actions, educational politics and by regulating the capital markets. Governments effect to demand conditions by setting up norms to products which will have effect on customers' needs. Government can also be a significant customer to some industries. It can be a major buyer in aviation industry, tele communication and materials used in national defense. The politic that government practices effects also in companies' strategy, structure and rivalry for example through tax politic. The politic that government practices fails if it the only source of competitive advantage. Successful political choices will work in industries where they support the factor that create nations competitive advantage. (Porter 1998, 176-178)

Vietor (2007) adds that firms benefit from healthy economies with growing markets. They also benefit from wage growth that is slower than productivity growth, from the availability of educated workforce, from relatively liberal working rules, from low interest rates that encourage to investments and as little corruption as possible. (ibid. 2)

3.4 SWOT analysis

The word strategy was at first used mainly a military term. Later business world started to use it also. Strategy is a plan for controlling and utilizing recourses (human, physical and financial) with the goal of promoting and securing vital interests. The strategic choices available to a company emerge from process of looking inside and

outside. Strategic planners refer this activity as SWOT analysis. (Harvard business essentials 2005)

SWOT analysis was invented in United States in the 1960's to analyze companies or industries strategic position comparing its strength, weaknesses, opportunities and threats. The purpose of this tool is to produce clear picture of industries or companies state what can be used in creating more efficient strategy. In SWOT analysis the strengths and weaknesses are companies or industries inner matters. Opportunities and threats are related to the environment where industry or company operates. The full picture of SWOT analysis can be seen in Figure 8. The basic thoughts behind this analyze are that when analyzing strength of industry, it is important to analyze how strength are utilized now and would it be possible to utilize even better. When analyzing weaknesses, one must think that could the weaknesses be mitigated or removed that company or industry has. When analyzing opportunities, one must analyze that are the current opportunities been utilized as well as possible. And when analyzing threats, it is important to think that would it be possible to mitigate or remove some threats and if possible, to turn the threat as opportunity. Examples of strengths might be superior quality of products and example of weaknesses could be expensive productions costs. One example of opportunity could be that the technological trend is now favoring superior quality products and threat could be that government policy of against the industry might change in the form of raised taxes. (Vuorinen 2013)

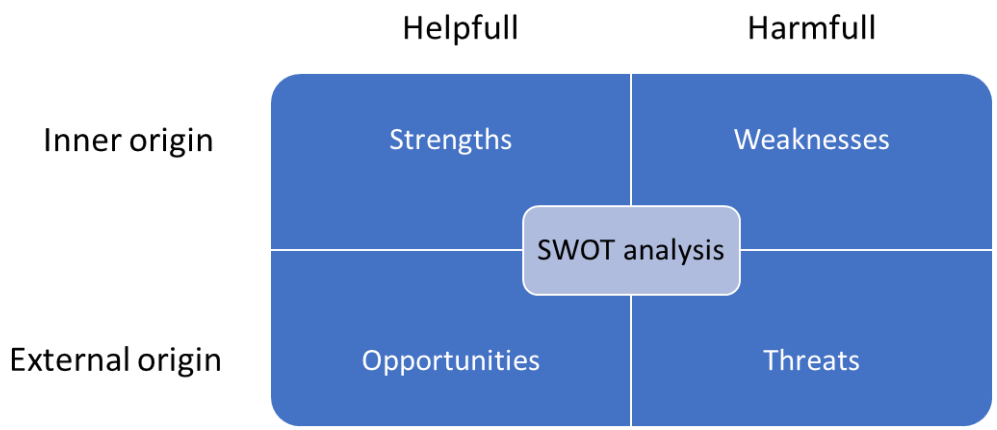


Figure 8: SWOT analysis

Source: Vuorinen (2013)

4 Methodology

4.1 Research approach and strategy

The goal of this study was to the answer the following research questions:

i. What are the strengths, weaknesses, opportunities and threats of the pharmaceutical industry in Finland?

ii. What is the competitiveness of the Finnish pharmaceutical industry?

iii. How has the Finnish pharmaceutical industry changed since Laihonsalo's study 'The competitive advantage of the Finnish pharmaceutical industry' published in 1994?

In order to be able to answer these questions, the author chose the qualitative research approach. Qualitative research gives answers to questions like 'how' and 'what' rather than 'how many' or 'how much'. It is primarily concerned with meaning not measuring. (Keegan 2009, 45.) The data was collected by interviewing experts who operated in the industry as well as from publications, books, articles and government websites. According to Saunders and colleagues (2012), the nature of a qualitative research project can be exploratory, descriptive, explanatory or a combination of these. Exploratory research can be conducted by searching literature and interviewing experts. If the researcher is unclear about the detailed nature of the research problem and needs to find the right answer for understanding it, then exploratory research is recommended. That is why this study became exploratory. (Saunders et al. 2012, 171.)

4.2 Data collection

As mentioned before, the data of this study was collected by interviewing experts who operated in the industry as well as from publications, books, articles and government websites. This data was identified as primary and secondary data.

Data that was collected originally for other purposes can be defined as secondary data. For this study, secondary data was collected from multiple sources as mentioned before. Secondary data can come from three different sources: documentary, survey and multiple based data sources. (Saunders et al. 2012, 307, 681.) As secondary data, this study used mostly documentary and multiple based data sources.

Data collected especially for a research project can be defined as primary data (Saunders et al. 2012, 678). Myers points out that primary data adds richness and credibility to qualitative research (Myers 2013, 120). The primary data for this study was collected from three experts who currently work in the industry.

Interviews can be divided in three different types: structured interviews, unstructured interviews and semi-structured interviews. This study used the semi-structured approach. The semi-structured interview approach means that there are pre-formulated questions but that there is no strict adherence to them (Myers 2013, 122). Each interviewee was given the same questions, but some focusable questions were asked if it was considered important for the study. The questions were set to give answers about the competitiveness of the Finnish pharmaceutical industry. Another objective was to determine the major changes that had happened in the industry in the past 25 years. This was done by comparing the results to Laihonsalo's study from the year 1994. In order to be able to answer the research questions, this subject was researched by using Michael Porter's diamond model and a SWOT analysis. The set-up of the questions was formed based on those theories. From the diamond model's point of view, the research questions ought to find answers to what the current state of the competitiveness of the Finnish pharmaceutical industry was. The questions were designed to give answers about the following factors that affect the competitiveness of the Finnish pharmaceutical industry:

- factor conditions
- demand conditions
- related and supporting industries
- firm strategy, structure and rivalry
- Government influence

There were also questions related to the SWOT analysis: What are the strengths, weaknesses, opportunities and threats of the Finnish pharmaceutical industry? The interviewees were also asked to give their views about the past major changes in the industry. The questions were sent to the recipients via email. They were able to give straight answers by email or they could schedule a phone interview. The questions that were sent to the experts of the industry can be seen in Appendix 3. These questions were sent to 12 experts.

Most of the experts worked in the industry, and the rest represented the Association of the Pharmaceutical Industry in Finland and the Association of the Generic Drug Industry in Finland. This group of representatives was chosen because they had worked in the industry in high positions for a long time. They had a wide range of opinions about the industry. Many of them had worked in various positions and done international business. Three of the experts agreed to participate in the interview.

The author thought that participating in this kind of a study would have been a sufficiently good motivation and that the results of the study and thirst for knowledge would have been the biggest motivators. Apparently for some reason, he did not manage to obtain more answers in this time frame.

The interviews were executed between the 14th and 21st of May in 2019. The experts who answered these questions worked in key positions in the Finnish pharmaceutical industry. The length of the interviews varied between 45- 60 minutes. The interviews were carried out in the Finnish language because all the participants were native Finnish people including the interviewer. The author wrote down the answers of the interviewees for further analysis. The author wanted the interviews to be as natural and truthful as possible. According to Berndtsson and colleagues (2008), recording an interview may be regarded as distraction and cause interviewees unease and lead,

perhaps, to less valuable responses. The author did not want to take that risk, and that is why the conversations were not recorded.

4.3 Data analysis

This study was made by using qualitative data. This kind of data is non-numeric, and it cannot be quantified. Qualitative data is based on meanings expressed through words. In order to understand this data, it must be analyzed. There are two different approaches that one can use in analyzing qualitative data: the deductive approach and inductive approach. If one uses an existing theory to formulate research questions, the recommendation is the deductive approach. This approach will also link the research to the existing knowledge of the subject area. (Saunders et al. 2012, 546-549.)

Categorizing data will rearrange the original data to analytical categories. With this simple task, it is much easier to organize and analyze data further. (Saunders 2012, 557.) The data of this study was analyzed based on themes that emerged in the answers to the research questions. The available secondary data was analyzed and categorized thoroughly, and the answers of the interview were written precisely, and the written answers were then checked by the interviewee. With this method, the author minimized the risk of misinterpretation. The data analysis itself was done by using coding with the help of the Excel software. Different categories were created according to the different challenges, and both primary and secondary data was used to find answers. In this way, it was easier to find the answers to the different challenges.

There were three interviewees, and they included experts from two top firms of the Finnish pharmaceutical industry, Orion and Verman. One interviewee also worked in a high position in the industry and represented the Association of the Generic Drug Industry in Finland. The collected data was sufficient for carrying out the research. According to Myers, in qualitative research the number of interviewees is not relevant. Instead, it is important to consider how many interviews are enough for the current study (Myers 2013. 122-123). In this case, very important information was

received from the interviewees, and although they worked in different companies, they had a similar picture of the competitive advantages of the Finnish pharmaceutical industry. All the (most) relevant factors were repeated in the respondents' answers.

4.4 Research ethics

Ethics are critical aspect when conducting research. Ethics should be followed throughout the research process in all parts of it. Ethical issue includes, for example, integrity and objectivity, respect, avoidance of harm, privacy, voluntary participation, right to withdraw, informed consent, confidentiality and anonymity, responsibility and analyzing and reporting, data management compliance and safety. (Saunders et al. 2012, 236- 249.) In this study, participation was voluntary, and no encouragements were offered to the participants. The author's interest in the subject was the inspiration for the study, so the author was not assigned to do the work, and he did not gain any profit for accomplishing the study. The author respected the participants, and no harm was caused. The interviewees fully understood what the concept was when they agreed to participate. All the interviewees were given the questions before the interview. Privacy of the interviewees was respected, and their names of were not or will not be published. Moreover, detailed information concerning the answers will not be published.

4.5 Verification of results

Laihonsalo's study about the competitiveness of Finnish pharmaceutical industry form year 1994 was used as reference to this study. This study was able to produce same kind of results than Laihonsalo's study and give additional information about the current state of the competitiveness of Finnish pharmaceutical industry. The results gave answers to research questions. Secondary data was gathered from reliable sources e.g. governmental websites, companies own websites, websites of related associations and recommended books. Data was carefully analyzed before use and it could be confirmed through other sources. Almost all statistical information was gathered through Pharmarket data. Pharmarket statistics is reliable source which provides market sales data to the pharmaceutical industry in Finland. Pharmarket data is provided from the pharmaceutical information center in Finland.

Concerning interviewees, the interviews were semi- structured. According to Saunders et al (2012) lack of standardization in these types of interviews may lead to concerns about reliability. In this study all interviewees were given the same set of questions and focusable questions were asked if it was useful for the study. For example, interviewee was asked to be more precise if he had answered that infrastructure in Finland concerning Finnish pharmaceutical industry is ok. No leading questions were asked. Interviewee bias is also one factor that need to be overcome to make the study more reliable. (ibid. 382) To overcome this issue, author made following measures: the questions were tested and made understandable, behavior of the interviewer was polite throughout the interview, interviewer was able to stick to schedules what was agreed with participants and since the interviewer himself had been working in the industry over 10 years he had familiarized himself well to the context. The interviewees saw the subject important and showed respect to the study.

5 Results

The Results part has three different chapters. The first chapter addresses the competitiveness of the Finnish pharmaceutical industry based on Michael Porter's diamond model. The second chapter discusses the strengths, weaknesses, opportunities and threats of the Finnish pharmaceutical industry by using SWOT-analysis as a tool. In the third chapter, the results are compared to Laihansalo's study results from 1994. The chapter deals with Orion quite extensively because Orion is seen as a dominant player in the Finnish pharmaceutical industry. The company is the number one in the Finnish market, and it is basically the only company that invests in the development of new pharmaceuticals and markets them by itself. Orion's size in turnover is also superior compared to its Finnish rivals. In 2018, Orion's sales were 977 million €. Verman's and Vitabalanses sales in 2017 were about 29 million €.

5.1 The competitiveness of Finnish pharmaceutical industry based on Michael Porter's diamond model

5.1.1 Factor conditions

Finland has educated people who are suitable for the industry, and the quality of general education and the education system support the industry. The education is also cost-free. In the pharmaceutical industry, many kinds of competences and educational backgrounds are needed. The industry itself has its unique characteristics. That is why there is no education available for some of the jobs in the industry. For example, there are tasks available for registration experts and health economic experts. These tasks include, for example, pricing in the reimbursement system of the target country from a health economics perspective. For these kinds of tasks there is no direct education. Health care related education or pharmaceutical education gives the employees good background information, but the industry and

tasks themselves must be learned through work itself. According to a Tekes report by Valtakari, Riipinen and Voutilainen (2013), Finland has started to direct medical education from clinical research to more practical education. According to the report, scientific merits do not guarantee good career development as they used to, so that clinical research has decreased especially in the 21 centuries.

The common knowledge resources are good, for example, if one looks at this from the point of view of pharmaceutical research and development. Nowadays, we have top competences in biomedicine even according to international indicators (The association of pharmaceutical industry in Finland 2012). The world has changed because of the internet, and today, it is also possible to utilize international sources of information more easily. Statistical information about the industry and market sales is also quite easy to access, and the information is provided through reliable and independent sources. Certain key opinion leaders are also seen as good information resource.

The infrastructure serves the Finnish pharmaceutical industry well. Finland is a well-developed country, and it moves information or merchandise effortlessly. In the pharmaceutical industry, some products may have to be transported as cold shipments. Even those can be transported and stored without problems. Finland is also part of the EU. This enables the free movement of people and products. Capital resources are also in a good state. If there is a good idea, the capital is available. Commonly speaking, the companies that operate in the industry are doing fairly well, and the availability and the total costs of the available capital do not restrict the operations of the Finnish pharmaceutical companies. In this context, it is important to mention that no representatives of startups or mainly subcontractor firms where interviewed.

Regarding startups, the Association of the Pharmaceutical Industry in Finland announced in its report in 2012 that pharmaceutical startups were having difficulties with obtaining funding. When starting up a pharmaceutical company that does research and develops totally new products, the need of capital is big at the beginning. This is because the pharmaceutical research and development process is so expensive. According to the study (ibid.), if Finland wants new companies to the pharmaceutical industry, this needs single-minded local investment. These kinds of

actions would also attract international investors. (The Association of the Pharmaceutical Industry in Finland 2012.)

5.1.2 Demand conditions

The demand conditions of pharmaceutical differ when comparing them to traditional products. The ageing population and the increasing interest of people to treat themselves create demand and this demand is increasing. (Kostiainen 2019) When focusing in prescription medicine the source of demand is the patient who wants to receive help for some sickness or discomfort. If the doctor evaluates that pharmaceutical treatment is needed the patient obtains a prescription. Then patient goes to pharmacy to buy the medicine. If the medicine is substitutable the patient can ask for cheaper option. It is also possible to ask for example a product that the patient has used before, if some reason the doctor has not prescribed it in a first place. So, patient has a little choice in choosing the medicine and addition the marketing is only allowed to doctors that are allowed to prescribe the medicine.

In otc medicine the demand is similar to "normal" consumed product demand. Products are available in pharmacies and marketing is allowed to consumers as long it follows the ethical instruction of pharmaceutical industry. The main focus of the pharmaceutical companies is the prescription medicine. As Table 10 shows that prescription market is almost ten times bigger in Finland than the selfcare market.

Table 10. Dividing of prescribed and otc medicine sales in Finland at year 2018

Source: Pharmarket (2019)

Row Labels	Sales € Counted
Prescription medicine	2 326 844 710
Self care medicine	289 721 441
Grand Total	**2 616 566 151**

The pharmaceutical industry has many kinds of customers. They are patients, consumers and pharmacists. The customers itself are quality oriented and all the customer entities must be noticed and thought through in developing products or services. Throughout the world the pharmaceutical industry is quality centered, and companies must prove and maintain their quality in every operation. Otherwise they cannot operate. So, the high quality of medicines / products is a must if company wants to operate in the industry. The ethical guidelines of pharmaceutical marketing may vary from nation to nation. In Finland the association of pharmaceutical industry of Finland has created ethical guidelines to support the government officials who monitor pharmaceutical marketing. Talking about pharmaceutical marketing in Finland companies are allowed to market otc- medicine to consumers/patients. Prescription medicine are only allowed to market to physicians who can prescribe the marketed medicine. The ethical guidelines monitor that pharmaceutical marketing is being done according the guidelines. The guidelines also monitor that the marketing itself is also being done in a sort of manner that it does not encourage to misuse. In Finland these guidelines are being followed strictly. Ethical guidelines may have a restrictive effect to nations demand conditions on pharmaceuticals. Although it limits the safety issues in this industry are the most important and they should not be neglected. Environmental issues and global responsibility are big subjects in 2019. To be prosperous in long term companies must act ecologically, economically and socially sustainable way. This kind of company is profitable and competitive. (The association of Finnish economy 2019). This kind of thinking of customers have made companies to put effort, set goals and share the goals global responsibility with the public. (Yle 2019) For example, Orion mentions in its global responsibility report that it is estimated that 88% of pharmaceutical residues result from the general use of pharmaceutical products, 10% of pharmaceutical residues result from the improper disposal of expired and leftover pharmaceutical products and just 2% pharmaceutical residues result from production. Orion says that it also invests to environmental responsibility throughout the products life cycle. (Orion 2019). Milton (2017) did a research of responsibility of Finnish consumers which says that 74% of Finnish consumers are ready to pay more about products or services if they were produced in responsible way. When it is asked more specific that aspects in the responsibility are the most important ones the answers divided accordingly:

safety 36%, ethicality of supply chain 33% and where the company is paying its taxes 32%. Also 57% of the consumers said that they do not receive enough information about brands and companies responsibility. (ibid.) Addition to this, studies can be found that Finnish people prefer to buy Finnish products. (Yle 2009). This kind of behavior could reflect to pharmaceuticals also, but it would need some further investigations. No secondary data was found that would support this assumption.

Orion has a strong position in the Finnish pharmaceutical market. As seen in Table 2, Orion is number one in the Finnish pharmaceutical market. In that competition Orion has done well but what works in Finland does not necessary work in other countries. Orion has different kind strategies in different countries. According to Orion's financial statement about, 30% of the companies' turnover comes from Finland and the rest comes from abroad. (Orion 2019). Company seems to focus strongly to its own developed products in foreign markets. Orion also markets generic pharmaceutical in abroad, but the main market is Finland. This could be interpreted that the level of demand has not created Orion a competitive advantage in international markets. According to pharmarket data, from the other Finnish pharmaceutical companies Verman is in place 29 and Sabora is in place 57. Vitabalans does not announce its sales figures in Finland but in 2107 companies' total turnover was about 29 million €. Like mentioned before in this study Vitabalans and Verman operate internationally but most of the company's sales still come from Finland. It seems that in the sales perspective, the lever of Finnish customer demand has not created any competitive advantage to these firms.

5.1.3 Related and supporting industries

Co-operation with universities and other co-operation in research is seen as important factor. At the end state of clinical trials are often made in co-operation with hospitals. That's why the co-operation with hospitals is seen important. At 22nd of May 2019 there were17 pharmaceutical research processes that recruited participants to phase 1-4 studies. These pharmaceutical researches were held in

many Finnish hospitals e.g. Helsinki, Turku, Tampere, Jyväskylä, Oulu and Espoo. (Clinicaltrials.gov 2019) Phase 1-4 studies reported to Fimea can been in Table 10. The table shows that there is some variation in total studies conducted per year. The total number of studies have declined from 2008 but it they are also raised from the lowest year 2014. According to the association of pharmaceutical industries study in 2012 Finland has traditionally been a country where high quality pharmaceutical research has been made but Finland's research infrastructure has not been developed when at the same time other countries have developed their pharmaceutical research infrastructure and improved their price and quality ratio. This can be seen as a reason for the drop of conducted phase studies in Finland.

Table 11. Phase 1-4 pharmaceutical studies in Finland

Source: Fimea (2019)

Year	Phase I	Phase II	Phase III	Phase IV	Total
2008	55	47	108	58	268
2009	33	39	78	51	201
2010	21	35	109	44	209
2011	13	35	62	31	141
2012	13	37	74	44	168
2013	17	30	74	31	152
2014	14	22	59	33	128
2015	24	39	79	42	184
2016	20	38	81	42	181
2017	26	44	51	23	144
2018	22	33	66	29	150

The biggest wholesalers in the industry Oriola and Tamro are international companies and they have modern ways to operate which supports the whole pharmaceutical industry in Finland. There were also several companies that make active substances in Finland which can also work as a subcontractor for Finnish pharmaceutical industries as well as to foreign companies. Orion itself has an affiliated company Fermion that manufactures active substances to pharmaceutical industry. These can be seen as beneficial to Finnish pharmaceutical industry, but it is

not sufficient, or it is not utilized good enough that it would create competitive advance to the industry.

5.1.4 Firm structure, strategy and rivalry

Pharmaceutical industry is considered as highly profitable industry on average. Product patent protection times are long and when talking about pharmaceutical brands people are not so price conscious. To enter the industry with a totally new product companies must invest highly to r&d. With new pharmaceuticals competition has rarely been with the price. The real competition has been in r&d and that has increased the total volume of the industry. (Porter, 1998) The competition with price begins after the patents have expired.

Concerning pharmaceutical products there are numerous payments that need to be paid to government official to obtain the permission to sell the products. For example, company decides to apply marketing authorization to generic product via decentralized procedure. This will cost to the company 12 000€. With this procedure company can apply marketing authorization to other countries at the same time. For the first country the additional payment is 1 900€ and after that every additional country costs 1 100€. If company wants to apply for a reimbursement, for generic pharmaceuticals the commission fee for the pharmaceutical price committee is 2000€. After that the company must pay 680€ annual fee to keep the product in the market. Companies must pay these fees for every product. This will also raise the barrier for new competitors to enter the market. In addition, Finland has relatively high taxation and the level of wages. Setting up a company is expensive and for a new business a stable market position should be able to create fast, before rivals the enter the same markets. Like mentioned before this line of business requires also special expertise e.g. in medical and regulatory sector. Companies can do these tasks itself, but it requires professionalism. These kinds of works can also be outsourced but it is more expensive. All these facts raise barrier for new rivals to enter the market.

Rivalry in the Finnish pharmaceutical market has increasingly been with price. As mentioned before in this study generic substitution was implemented in 2003 and implemented the reference price system 2009 by government. These increased the price competition in Finnish market. Also, the tender system of the hospital districts prefers the lowest prices. Quality standards are so high in pharmaceuticals that it is safe to arrange tender bidding that is almost totally based on lowest prices. This kind of actions save governments money and makes companies compete aggressively with price. Similar systems are used in most of the western countries. Pharmaceutical companies must adapt the fact that prices eventually go down in most products. That's why it is important to put effort on R&D to develop new products.

All the interviewees agreed that the rivalry of Finnish pharmaceutical market does not create any competitive advantage internationally. In this environment Orion has been able to maintain its position in number one in the market. Finland is small market and one might make a conclusion that the good position in Finland definitely benefits Orion and with the help of good position of Finland it has been able to reach out in the foreign markets in the first place, but it does not create competitive advantage compared to other international firms. The situation might be different if the Finnish pharmaceutical market were much bigger.

According to Orion's financial report 2019 the company market wide variety of products in its home market. In the international markets the selections of products is smaller and there company focuses mainly to market its own developed products. The global focus on these products may help Orion achieve economies of scale. Orion's strategic targets are: growing faster than markets, providing new innovative and cost- effective drugs and treatments to patients, working together to benefit customer, continuous improvement of performance in sustainability and strong development in profitability. Orion continues to put effort to research and development with the hope of new innovations.

Vitabalans strategy was not visible. The company has started export in 1995. They have 3 production plants and sales and marketing organizations in 14 countries. Based on their staff the main focus is in Finland. Verman strategy was not visible either. Company is mainly focused in Finland and it has been expanding abroad also.

Verman's website tells that they are going to strengthen their position in Middle East and Asia.

5.1.5 The Role of government and chance

Finnish government officials operate similar way as in other countries. Especially because Finland is member of EU there are same requirements and legislation in other EU countries as well. For example, the processes to gain marketing authorization are the same. However, as Finland has traditionally been a nation with high quality products, if some pharmaceutical product has been granted marketing authorization to Finland it can be seen as a good reference to other nations and with that reference it is easier to apply marketing authorization so other countries. Pharmaceutical industry itself is quite small in Finland. In form of government support it has been treated like any other industry. In fact, pharmaceuticals have been seen as target of "easy savings" regarding the whole cost of health care. Intensifying the health care system in Finland has been challenging otherwise and it has been easier to cut the medical costs. However similar actions have been made in other countries too. So, this is not a disadvantage for Finnish pharmaceutical industry compared to elsewhere. Like mentioned before lack of funding to the pharmaceutical start up's does not increase the level of competitiveness in Finnish pharmaceutical industry but it is easier to existing companies can get funding if needed.

The government has created good circumstances to people to live in Finland. Infrastructure works well, and people have good standard of living. The government does its own part of making Finland known to world and the puts effort to tourism. That way the awareness of Finland grows. However, location of Finland and its four seasons may not be that attractive to foreign people. These factors might be seen as challenge to lure in professionals from other countries.

5.2 SWOT analysis

This section concerns to discuss about strengths, weaknesses, opportunities and threats of Finnish pharmaceutical industry. The quick analysis can be seen in Figure 9. Many of these factors has been discussed before in this study because same issues came up analyzing the different factors of the diamond model. That is why some facts are dealt lightly in this section.

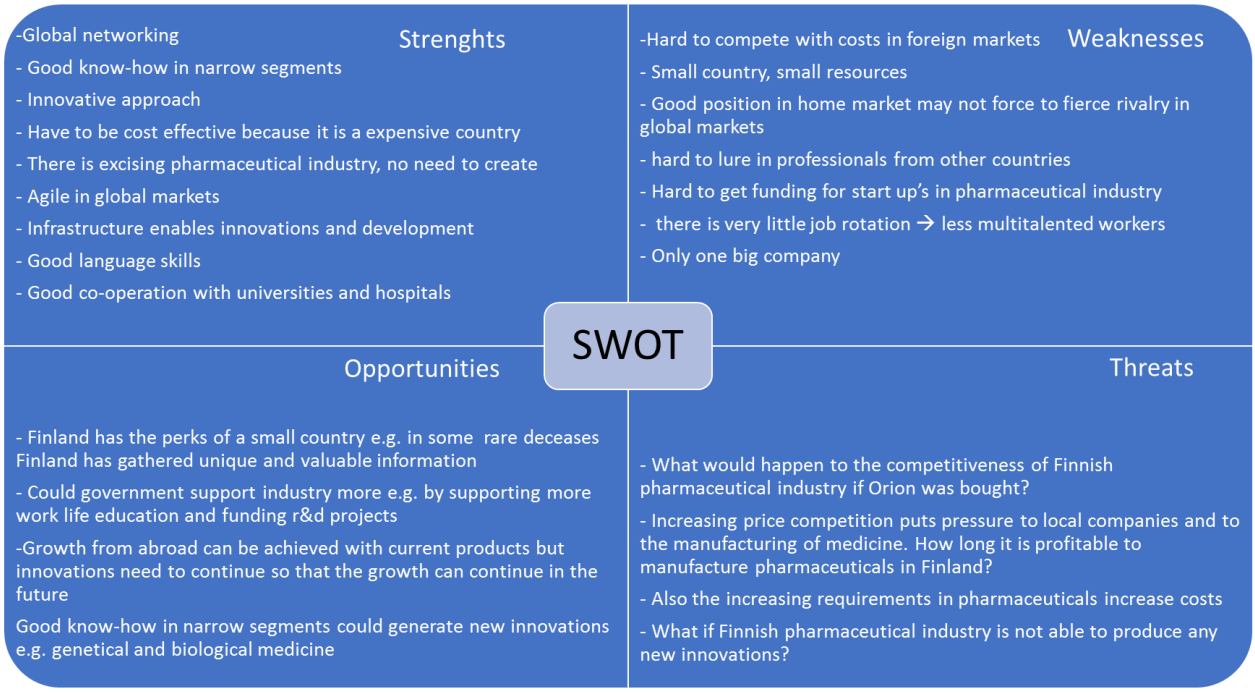


Figure 9. SWOT analysis of the Finnish pharmaceutical industry

5.2.1 Strengths

The quality of Finnish work force has been discussed earlier in study also. It can be seen as strength of Finnish pharmaceutical industry. People are well educated, and they are hard-working. (Talouselämä 2016) Innovativeness is also seen as a strength. This came up in the interviews. The pharmaceutical industry of Finland needs new innovations to be able to take the next step. Because of the existing price competition, increasing requirements and relatively expensive home country

companies must be cost effective to able compete in the Finland and in international markets. The fact Finnish pharmaceutical industry is small with international meter's that may bring some agility and flexibility to operations. According to the interviews being a challenger may force to operate new and better way.

The Finnish infrastructure is in such a good shape that it will enable innovations and development. It also creates some security because people may rely on it so well. Any kind of knowledge is available and harbors, airfields, roads, available energy, research environment, waste management and communication seem to work well according to interviews. Finnish people also have good language skills and the new generation is given even better basic skills in language on average than the people who are now in key positions in the Finnish pharmaceutical industry. One could not say that language skills limit international business.

The good co-operation with universities and hospitals can also be seen as a strength of Finnish pharmaceutical industry. The co-operation is valuable, and quality is good. Pharmaceutical companies do not have the kind of facilities and resources that hospitals have. That is why it is very important that hospital co-operate with pharmaceutical companies when new medicine are under development in the clinical trial phases. The fact that Finland has pharmaceutical industry is seen as a strength. It came up in the interviews that existing industry enables development. If we did not have it, it would be difficult to start building it at this stage.

5.2.2 Weaknesses

Finland is a small country with high standard of living. The wages of people and tax rate of corporations is high. It is hard to compete with productions cost against for example India. Although Orion is doing well it is still relatively small against the big pharma companies. Orion invested 104 million € to r&d in year 2019. Roche a Swiss pharmaceutical company invested 8 585 million to r&d. This reflects the resources that are in use. Orion is performing well in Finnish market and it raises a question that does success in home market have affect to company's willingness to compete

internationally? If the competition would be more fierce in Finland and Orion would be challenged even harder, would it put pressure to develop international sales or would it make Orion to just defend what it has in Finland? One weakness also is that Orion is too big part of Finnish pharmaceutical industry. Whether it succeeds or not reflects to the whole pharmaceutical industry in Finland.

It came up in the interviews that there seems to be little job rotation in Finnish pharmaceutical industry. People come to the industry and they seem to stick in those tasks what they have. This limits the number of multitalented workers. Multitalented workers bring in comprehensive thinking with them. They see the bigger picture in work and they perceive the cause and effect relationships of different issues. It is seen that luring in professionals to Finland from abroad is hard as mentioned in chapter 5.1.5.

5.2.3 Opportunities

All the interviewees mentioned that government could support pharmaceutical companies more for example means of education. The industry needs specific kind of know-how which is not taught is school. Government could for example sponsor 6-month intern period to industry. It would bring more people to industry and barrier would be low for companies to take interns. In addition to specific requirements for industry itself is the increasing pace of development e.g. in digital sector puts more pressure to education. Government or its educational systems could co-operate more with pharmaceutical industry and bring more educational offering to educate people for these increasing requirements. Government supports pharmaceutical companies r&d processes through Tekes. Tekes has done many projects with pharmaceutical companies and without the help of Tekes many of these projects would have never been started. These projects and co-operation can be seen as opportunity which helps in innovation. Although Orion has been the one company who has had most of the support from Tekes. (Valtakari et al. 2013)

Finland has already gathered unique and valuable information about some rare diseases. In this matter being a small country is a perk because the data is easier to manage. This could be a valuable quality to use also in the future.

According to the interviews Finland has possibilities to grow in international market. The current portfolio of products enables the growth. For long term growth and development in the international markets requires innovations and new products. Finland has good know-how in narrow segments biological and genetical medicine. One big success product in this sector would be a major issue for the whole industry.

5.2.4 Threats

Because Finland only has one big player in the pharmaceutical industry it is also a big threat for the whole industry. What would happen if it would be sold to a foreign company. Would it eventually be good issue for the industry if a big company with big resources would buy it? Would it bring more professionals e.g. to r&d to Finland? Or would the foreign owner start to downsize operations because of costs?

Couple of issues was seen in the interviews as threat to profitability. The price competition puts pressure to local companies. The requirements concerning pharmaceuticals are also increasing e.g. in pharmacovigilance. How much manufacturing will be in Finland in the future? Will the local companies be able to develop more cost-effective ways to manufactory of medicine that Finland is able to maintain this kind of know-how with in the nations borders?

Also, a threat is that what if Finnish pharmaceutical industry is not able to produce any innovations? Existing companies may manage without new innovations but what happens to new firms? If their new products do not sell or some problems occur in the development process which already cost a fortune, will they be able to continue their operations?

5.3 Comparing the results to Laihonsalo's study from 1994

In Laihonsalo's study at 1994 there were two companies that were studied and interviewed. Orion and Leiras. Orion was number 1 in the Finnish pharmaceutical market and Leiras was on second place. As mentioned before in this study Leiras was sold and the company in Finland is now called Takeda. It is a company of Japanese origin. Orion on the other is still number one in the Finnish pharmaceutical market. According to Laihonsalo Orion had been in 96th place in comparing the size of global pharmaceutical companies in 1994. According to scrip statistics in 2016 Orion was in the place 93. (Scrip 2016) Back in 1992 Orion invested to r&d 227 million Finnish marks. That was 12,5% of company's turnover. In 2018 the invested sum was 104 million € which is 10,6% of the company's turnover. The sum is considerably bigger but it is smaller related to turnover. The co- operation with universities and hospitals have been important in 1994 also. The co-operation has been seen valuable through this time. The co- operation with foreign companies has also been part of the Orion's operations in 1994. According the Orion Financial review they still do that e.g. with Bayer. They have also operated in the foreign markets with more selective product range than in the home market. That is also similar matter that they do today. Orion's goal in 1994 have been to gain 1% market share in Europe's pharmaceutical market. This goal would have been achieved through acquisition of some middle European pharmaceutical company. (Laihonsalo 1994) According to the book of Orion history, this has not happened. (Joutsivuo & Parpola 2017)

Laihonsalo 1994 states that pharmaceutical industry fits well in a country like Finland where the availability of educated people is good, technology level is high, and all elements of infrastructure works. In 2019 matters are rather the same. Back in 1994 internationalization has been big target of Orion. Back then they have estimated that there is very little potential to grow in the home market. In year 1992 Orion's turnover have been 1695,5 million Finnish marks and from that 38% 475,3 million marks have been from foreign activities. In year 2018 company's total sales was 977,5 million € and from that 665,4 million € 68% came from foreign activities. Orion has indeed increased the share of export and nowadays most of the company's sales

comes from abroad. At the same time, they have continued growing in Finnish market too. In 1994 there has been three success products: Eldepryl for Parkinson's decease, Divina a hormone replacement treatment for women and Beclomet for treatment of asthma. Today Divina is still on the list biggest selling products and Orion seems to still focus on Parkinson's decease and asthma. Stalevo and Eaysyhaler product family is on the top ten list of Orion's biggest selling products.

Tekes – the development center of technology in Finland has been supporting pharmaceutical industry in its research and development processes. Laihonsalo mentions in her study that in 1989 Tekes started the development program of competitiveness of Finnish pharmaceutical industry. Programs goal was to strengthen the competitiveness of Finnish pharmaceutical industry and increase the co-operation between industries research and development and scientific research environment. The program was going to last 5 years and its cost was estimated to be about 50 million marks. One purpose was to renew outdated machinery and instruments in universities in Helsinki and Kuopio. (Laihonsalo 1994) No further knowledge about the project and the results was not available. In 2013 Tekes published its final report of pharma program and lääke 2000(medicine 2000) projects. The pharma programs were carried out in 2008 -2011. It purpose was to strengthen Finnish pharmaceutical industry and create more international business to the industry. The program included 78 projects with total funding of 78 million €. The medicine 2000 project included following elements: development of biopharmaceuticals, pharmaceuticals and pharmaceutical technology. The project was carried out in 2001- 2006. This program included 140 projects with total funding of 140 million €. Tekes share was 83 million €, Finnish academy's share 5 million € and the rest 52 million € came from companies. According to the project the problem with these projects was that the public funding excluding Tekes funding petered out during 2001- 2006. This has affected to r&d of the industry until this day. All and all, the experiences of these projects were mainly positive, but the concrete effects appeared to be little. (Valtakari et al. 2013)

6 Discussion

The target of this study was to enhance the understanding about the current state of competitiveness of Finnish pharmaceutical industry. The author believes that this task was completed and at same time admits that this is not a study that covers absolutely all issues that are related to the competitiveness of the industry. The main factors have been dealt with. Porter's diamond model as tool was good way to discover the factors that have affect to the competitiveness. Although the theory itself is from the 1990's, it had endured time well.

A reference study of the same subject was made 25 years ago in 1994. Companies in the industry are doing relatively well and on average pharmaceutical industry has relatively high profit margins. The nation would benefit from this kind of business through e.g. educated people, high technology know-how, though export and tax income. This subject was touched in chapter 1.1. That's why this subject was seen interesting and useful.

The main characteristics of the industry had been stayed the same since 1994 but naturally there had been some changes too: EU, technological development and decreasing prices.

6.1 Reflection to research questions

This study has three research questions. The first question was that what are the strengths, weaknesses, opportunities and threats of the pharmaceutical industry in Finland? The answer to these questions was found out with SWOT analysis. Chapter 5.2 and Figure 8 shows the main strengths, weaknesses, opportunities and threats of Finnish pharmaceutical industry. The main finding in SWOT was that Finnish pharmaceutical industry has good infrastructure and know- how to gain success through innovative approach. Through smallness of the nations the resources are also small and that reflects also to funding of startups, because the developing

process of pharmaceuticals is so expensive. Finland pharmaceutical industry relies highly to one company Orion. Whether Orion succeeds or not reflects to the whole industry. One big threat also is that what Orion is being bought. What happens the nations pharmaceutical industry then.

The second question was that what is the competitiveness of Finnish pharmaceutical industry. The competitiveness of the Finnish pharmaceutical industry was solved through Michael Porter's diamond model. The industry itself fits well in the country like Finland. Finland has well educated people and good infrastructure what enables the operations and development of pharmaceutical industry. Although local companies are doing well and Orion is the number one in the market, Finnish companies do not obtain any competitive advantage from home market when competing in the international markets. That is because the product range and characteristics of markets are different. The smallness of the market may push companies to go global and the perspective of developing new pharmaceuticals it is so expensive that companies have to target the global market so the whole process will be profitable someday. The barrier for new rivalry is high because of high development cost of new products and high maintenance costs of products. Also, Finland in particular has high standard of living and it means high wages and high marketing costs.

The increasing price competition has put pressure to companies to save costs. What will this mean for the Finnish manufacturing of pharmaceuticals? Can Finland compete with manufacturing cost against countries that have lower cost structure? In Tekes study report (2013) there is mention that there has been some kind of joint research where Tekes and Orion has tried to study how the development process of pharmaceutical could be shortened. The results have created a sort of staircase where new things can be built on previous one and utilized in practice. According to the Tekes report, Orion benefits the most of Tekes funding's. (Valtakari et al. 2013) Could this support be divided more to start ups?

The government has created good circumstances for people to live and prosper in Finland. Still it has seen hard to get professionals to move Finland. What comes to regulations in pharmaceuticals the Finnish government operates similar way as in other EU countries. Also, the government does not particularly support

pharmaceutical industry. The industry itself is one part of the nation's industries. Also, the government cannot favor local companies in its procurements for example in hospital tenders. The conditions of tenders are same for all companies and the main choosing criteria is the price.

The third research question was that how has the Finnish pharmaceutical industry changed since 1994 Laihonsalo's competitive advantage of Finnish pharmaceutical industry study? Company called Leiras used to be big player in Finnish pharmaceutical industry but couple of years after Laihonsalo's study the company was sold. So, from companies that manufacture, develop new products and markets them itself there is basically only Orion left. That is a big change since 1994.

EU brought change through free movement of products and people. After 1995 the number of foreign owned companies started grow more rapidly. Also, the harmonization to regulatory processes within EU made applying marketing authorizations to whole EU area more simple. The increased price competition through generic substitution and reference system has changed the dynamics of competition and biological medicine has entered the market.

6.2 Implications

Going through the secondary and primary there were some key challenges that came up. One was the funding of startups. Tekes says in its report (2013) that it is sole funder of pharmaceutical r&d from the public side. If the amount of funds could not be increased could Tekes or some governmental entity orchestrate some kind of event for foreign investors where they could meet the representatives of Finnish pharmaceutical industry and through that Finnish projects could obtain the funding they need. It was unfortunate that no one from fresh side of pharmaceutical companies participated to the interviews but those who did said that there are limitations to funding of startups. The secondary data supported this theory e.g. from Tekes.

Like it has been dealt before on in study, Finland has existing pharmaceutical industry but there is only one big player Orion. There are couple of smaller players in Finnish

and international market Verman and Vitabalans but that's about it. There is also companies like Delsitech, Forendo pharma and Syrinx bioanalytic that provides high standard know-how in narrow sectors. It would be very desirable for the Finnish pharmaceutical industry that there would be another big player in the Finnish pharmaceutical industry in the future. How could this be achieved? There has been discussion and articles about Finnish sales persons. For example Talouselämä (2016) wrote in its article that that weakness of Finnish people sales skills is the sales itself. So, the question is that could sales and marketing operations be intensified in Finnish pharmaceutical industry? How Finnish people do sales traditionally? Do they want to break boundaries, or will they do everything by the book? Would it be possible for Finnish companies to acquire sales and marketing know-how form other country? If it is hard to lure in the foreign professionals would it be possible to set up sales and marketing center in place where they know how sales is done?

Regarding the know-how and multitalented people. If the industry would benefit from people who are multitalented, why there so little job rotation. Is it because of the companies do not give change for this or is it because of the reluctance of workers to apply different kind of jobs that they have? Either way, the companies could set up some kind of programs where workers would have to do other kind of jobs as well. For example, the workers could have their main responsibility for 70% of their time but the rest 30% they would have to do some other kind of job. This kind of rotation could last for example two months per year and it would increase the comprehensive know-how of the workers and encourage to apply for new kind of jobs. The ability to commercialize product was brought up also by Valtakari et al (2013) in Tekes report.

When looking at the Orion's development of sales in the past five years, the figures have been quite similar. There most definitely are plenty of explanations that what are behind those figures but if one just looks the development of sales, there is not any. (Orion 2019). According to Laihonsalos study (1994), Orion invested 12,5% of its turnover to r&d. Last year Orion invested 10,5% r&d. Although, company's turnover has grown s lot throughout the years, so are the development cost of pharmaceuticals. Would Orion gain more out of r&d if it would invest more to it?

How much more extra annual invest to r&d and for how many years would bring more results out of it?

There was a question in the interviews that what kind of development interviewees expect from the Finnish pharmaceutical industry in the next ten years. Every one of the interviewees would like to see some new innovations. With the help on good know-how it is seen possible. Orion is expected to be the only big player so lot of the pressure to innovate turns to Orion's way.

In the interviews a question came up that is Finnish society supporting innovations? Are companies receiving appreciation from innovations, the kind of appreciation that will want people to join the industry? Nation should be openly proud for its achievements. This kind of recognition would high light the industry and lure in more people.

6.3 Comparing results with earlier literature

There is little of new knowledge to be found on the subject that was not mentioned before in the earlier literature. Although Laihonsalo's study (1994) came out 25 years ago the characteristics of Finland as a foundation for pharmaceutical industry had stayed quite much the same. The smallness of the Finnish country, market and resources were one of the challenges that were recognized. Also, the educated people, good co-operation with hospitals and universities and the well working infrastructure was mentioned in the interviews. The changes of the industry and market was similar in other EU countries as well, so they were not specific only to Finland. The whole industry seems to work globally and there are same characteristics in many countries. Naturally the market has changes and that has also made changes to Finnish pharmaceutical industry. Finnish pharmaceutical industry has evolved with industry and companies have adapted their operations to markets needs.

Overall the earlier literature is consisted of bits and pieces. There is plenty of knowledge to be found but it is scattered around different sources. Laihonsalo's study (1994) and Tekes report of co-operation with pharmaceutical companies (2013) and the association of pharmaceutical industry's statement of r&d environment in Finland (2012) were biggest studies that the author could found on the subject. The last two do not handle the industries competitiveness as a whole, they only view parts of it. Similar key challenges come up also in this study. For example, in Tekes report Valtakari et al (2012) states weaknesses of the Finnish pharmaceutical industry: size of the market, distant location, hard to lure in investors, small recourse, only one company in the industry (Orion). And some strengths that came up in the same report: good infrastructure, good know-how in research and the quality of research is good. The statement of Association of Pharmaceutical Industry states the same that historically Finland has been a country of high level research. However, both of reports state that there is a lack in funding that prevents new businesses for come to existence. These facts also came up in the interviews.

Though, one recognizable issue is that the author recognized more challenges in the Finnish pharmaceutical industry than Laihonsalo did in 1994. Competition with prices was not properly started back in 1994 and there was no mention about the funding of startups which was seen as challenge in 2019. Laihonsalo (1994) also saw the smallness of Finnish companies mainly a positive matter. Small companies can act more flexible in global market than big ones. As in this study the smallness was seen as small resources compared the big competitors.

6.4 Limitations

In this research the number of interviewees could have been bigger. Although the author was able to interview people form high positions from Orion and Verman and there were plenty of similarity in the answers, it could have been better to gain wider perspective. From mainly contract manufacturing side or from the point of view of more recently started companies, participating to the interviews or obtaining their

view via email would have been welcome. The fact that the interviews were not recorded can also be seen as limitation. Although the answers were double checked from interviewees by author, there are issues that does not show in the interviews. Pauses, tone of voice, possible hesitation or excitement cannot be read from the answers. However, that was a conscious risk that was taken so that the interviewees would be as open as possible. From authors perspective interviewees were open and honest. They were interested in the subject and they had wide view of the industry. Answers were given truthfully.

The author itself have worked in the industry almost 11 years. Although this helped many times during this study it may have an effect that the author is too close on the subject and because of that he did not see everything. When working in some industry people hear plenty of assumption of different issues. The author has done his best to solve all the assumption that he has faced and find facts from various sources to reach certainty, so that risk of misinterpreting would be as minimum as it can be.

6.5 Recommendations for further studies

The funding of the startups in pharmaceutical industry was concerning fact that came up in this study. It has come up in chapter 2.2.1 that the pharmaceutical r&d process in expensive and the risk of failure are so high that it does lure in investors. In country like Finland where people are highly educated, and nation relies on innovations. It would be very important to have funding to these innovations. This way the high barrier to enter the industry would come down slightly. If the funding problem could be properly solved somehow, it would increase the number of Finnish companies in the industry. The competition would evolve, and the Finnish pharmaceutical industry would be more attractive to investors and most of all to its own government. It would be good to study the subject and try to discover ways to make the funding of startups in the Finnish pharmaceutical industry better.

It would also be interesting to study the need of education that the people in pharmaceutical industry has. It came up that in study that there is plenty of

knowledge that is not been taught by educational institutes. The level and need of education depends on the task itself and it might be important to solve that what are the most important gaps between basic education and real work life. Could some important task be included to basic education? So that the industry could have more prepared people from the school bench to enter the industry. In the same time, it would important to investigate where is the industry going and what are products or services in future and is the educational institutes reacting to changing needs of the future somehow.

The influences of job rotation to workplace would also be interesting to study. What kind of benefits does it have and what are the challenges? More importantly, does it have effect to companies' competitiveness? This kind of study would benefit other industries as well.

Like mentioned before, the author was not able to include any interviewees from the start up side or more fresh part of the industry. It would be important to conduct a study from their point of view also. It would give important information about their situation and needs. What their opinion about the competitiveness of pharmaceutical industry in Finland is and how could it be improved. It would be interesting to know how they had managed to get funding and how could that could be improved from their point of view.

It also came up that the infrastructure of pharmaceutical research and development has not developed Finland like it has been developing in other countries. This information is from year 2012. It would be important to study what is the current situation of Finnish pharmaceutical r&d infrastructure. What is current state and is there need for development.

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Appendices

Appendix 1. Top 50 most selling pharmaceutical products in Finland, year 2018

	Product & marketer	Annual sales €
1	REMICADE -MSD	57 493 769
2	HUMIRA- ABBVIE	51 834 604
3	EPCLUSA- GILEAD	40 245 600
4	MABTHERA-ROCHE	34 663 698
5	REVLIMID- CELGENE	26 653 383
6	HERCEPTIN-ROCHE	25 985 058
7	XTANDI-ASTELLAS PHARMA	25 908 640
8	ENBREL-PFIZER	25 584 371
9	XARELTO-BAYER	25 324 436
10	AVASTIN-ROCHE	24 346 955
11	ELIQUIS-BRISTOL-MYERS SQUIBB	24 274 091
12	ZEPATIER-MSD	22 936 800
13	SIMPONI-MSD	21 581 621
14	EYLEA-BAYER	21 339 914
15	LANTUS-SANOFI	19 451 137
16	BURANA-ORION PHARMA	17 839 507
17	VAGIFEM-NOVO NORDISK	17 522 770
18	KLEXANE-SANOFI	16 230 262
19	VAXIGRIPTETRA-SANOFI	15 397 864
20	JANUVIA-MSD	15 210 320
21	GILENYA-NOVARTIS	14 431 991
22	LEVEMIR FLEXPEN-NOVO NORDISK	13 915 157
23	ENTYVIO-TAKEDA	13 779 936
24	TECFIDERA-BIOGEN	13 029 543
25	VICTOZA-NOVO NORDISK	13 017 218
26	LYRICA-PFIZER	12 281 410
27	OMNIPAQUE-GE HEALTHCARE	12 111 686
28	STELARA-JANSSEN-CILAG	12 005 056
29	PRIVIGEN-CSL BEHRING	11 941 200
30	JARDIANCE-BOEHRINGER INGELHEIM	11 322 192
31	ZYTIGA-JANSSEN-CILAG	11 209 652
32	PRADAXA-BOEHRINGER INGELHEIM	11 019 668
33	SERETIDE DISKUS-GLAXOSMITHKLINE	10 595 516
34	ARANESP-AMGEN	10 433 186
35	BEPANTHEN-BAYER	10 025 434
36	VOLTAREN FORTE-GLAXOSMITHKLINE CONSUMER HEALTHCARE	9 577 791
37	COSENTYX-NOVARTIS	9 858 444
38	FERINJECT-VIFOR PHARMA NORDISKA	9 810 900
39	SPINRAZA-BIOGEN	9 499 392
40	NEULASTA-AMGEN	9 370 515
41	ASACOL-TILLOTTS PHARMA	9 294 971
42	GAMUNEX-GRIFOLS NORDIC	9 125 545
43	SIMVASTATIN ORION-ORION PHARMA	9 062 555
44	ROACTEMRA-ROCHE	9 009 262
45	TRAJENTA-BOEHRINGER INGELHEIM	8 808 933
46	PANADOL FORTE-GLAXOSMITHKLINE CONSUMER HEALTHCARE	8 790 745
47	KYPROLIS-AMGEN	8 716 709
48	DUODOPA-ABBVIE	8 659 443
49	DUODART-GLAXOSMITHKLINE	8 643 680
50	REFACTO AF-PFIZER	8 353 097

Appendix 2. The hospital and pharmacy market of biggest biological medicine in Finland

Row Labels	Column Labels 2019-03 MAT €	MAT € Change%	MAT € MS%
Grand Total	**263 837 323**	**11,07 %**	**100,00 %**
Hospital/Primary care	**137 906 209**	**28,44 %**	**52,27 %**
infliximab	**70 057 549**	**57,11 %**	**50,80 %**
REMICADE	63 425 201	326,80 %	90,53 %
REMSIMA	4 886 268	-67,83 %	6,97 %
INFLECTRA	1 746 080	-87,99 %	2,49 %
rituximab	**35 860 844**	**4,04 %**	**26,00 %**
MABTHERA	34 620 555	0,63 %	96,54 %
RITEMVIA	1 023 187	1500,00 %	2,85 %
RIXATHON	217 102		0,61 %
trastuzumab	**26 952 443**	**11,99 %**	**19,54 %**
HERCEPTIN	26 328 378	9,40 %	97,68 %
ONTRUZANT	571 224		2,12 %
KANJINTI	52 842		0,20 %
pegfilgrastim	**1 612 571**	**102,64 %**	**1,17 %**
NEULASTA	1 612 571	102,64 %	100,00 %
filgrastim	**1 282 875**	**-0,91 %**	**0,93 %**
ZARZIO	819 501	12,87 %	63,88 %
NIVESTIM	243 171	-39,63 %	18,96 %
NEUPOGEN	218 299	32,44 %	17,02 %
ACCOFIL	1 904	95,14 %	0,15 %
adalimumab	**904 537**	**-15,65 %**	**0,66 %**
HUMIRA	865 662	-19,28 %	95,70 %
AMGEVITA	23 325		2,58 %
HULIO	15 550		1,72 %
insulin glargin	**784 965**	**32,63 %**	**0,57 %**
LANTUS	422 996	13,72 %	53,89 %
ABASAGLAR KWIKPEN	177 814	316,75 %	22,65 %
TOUJEO	155 270	-10,15 %	19,78 %
ABASAGLAR	28 885	552,73 %	3,68 %
epoetin zeta	**331 235**	**-4,67 %**	**0,24 %**
RETACRIT	331 235	-4,67 %	100,00 %
etanercept	**55 090**	**-8,74 %**	**0,04 %**
ENBREL	53 961	-10,61 %	97,95 %
ERELZI	1 129		2,05 %
lisinopril in insulin	**42 034**	**-21,62 %**	**0,03 %**
HUMALOG 100 KWIKPEN	25 838	-27,57 %	61,47 %
HUMALOG	11 050	-25,05 %	26,29 %
HUMALOG 200 KWIKPEN	1 717	72,37 %	4,09 %
HUMALOG MIX25 KWIKPEN	1 354	-33,01 %	3,22 %
HUMALOG JUNIOR KWIKPEN	1 159		2,76 %
INSULIN LISPRO SANOFI	820		1,95 %
HUMALOG MIX50 KWIKPEN	95	-50,83 %	0,23 %
somatropin	**19 635**	**9,44 %**	**0,01 %**
NORDITROPIN SIMPLEXX	18 554	19,23 %	94,49 %
OMNITROPE	1 082	-52,17 %	5,51 %
somatropin (human recombinant)	**2 431**	**-83,34 %**	**0,00 %**
SAIZEN	1 915	-85,32 %	78,80 %
GENOTROPIN	515	-66,67 %	21,20 %

Row Labels	Column Labels 2019-03 MAT €	MAT € Change%	MAT € MS%
Grand Total	**263 837 323**	**11,07 %**	**100,00 %**
Pharmacy	**125 931 114**	**-3,25 %**	**47,73 %**
adalimumab	**52 011 497**	**7,92 %**	**41,30 %**
HUMIRA	51 369 398	6,58 %	98,77 %
AMGEVITA	534 542		1,03 %
HULIO	88 766		0,17 %
HYRIMOZ	18 790		0,04 %
insulin glargin	**27 460 302**	**-3,13 %**	**21,81 %**
LANTUS	18 740 321	-1,46 %	68,25 %
TOUJEO	7 697 792	-8,88 %	28,03 %
ABASAGLAR KWIKPEN	974 010	16,90 %	3,55 %
ABASAGLAR	48 179	1,14 %	0,18 %
etanercept	**23 243 409**	**-24,26 %**	**18,46 %**
ENBREL	21 972 890	-28,38 %	94,53 %
ERELZI	1 270 519	15204,62 %	5,47 %
pegfilgrastim	**7 779 850**	**1,94 %**	**6,18 %**
NEULASTA	7 612 320	-0,26 %	97,85 %
PELGRAZ	167 530		2,15 %
somatropin	**5 254 316**	**12,25 %**	**4,17 %**
NORDITROPIN SIMPLEXX	3 123 220	9,11 %	59,44 %
OMNITROPE	1 221 528	11,30 %	23,25 %
NUTROPINAQ	335 522	6,18 %	6,39 %
HUMATROPE	288 118	0,75 %	5,48 %
NORDITROPIN NORDIFLEX	144 438		2,75 %
ZOMACTON	141 491	18,91 %	2,69 %
lisinopril in insulin	**2 659 353**	**-25,60 %**	**2,11 %**
HUMALOG 100 KWIKPEN	780 398	-63,27 %	29,35 %
HUMALOG 200 KWIKPEN	618 997	87,59 %	23,28 %
HUMALOG	549 625	-48,33 %	20,67 %
INSULIN LISPRO SANOFI	522 932	42977,24 %	19,66 %
HUMALOG JUNIOR KWIKPEN	142 145		5,35 %
HUMALOG MIX25 KWIKPEN	33 385	-17,10 %	1,26 %
HUMALOG MIX50 KWIKPEN	11 872	-19,04 %	0,45 %
somatropin (human recombinant)	**2 068 022**	**8,58 %**	**1,64 %**
SAIZEN	1 257 648	17,67 %	60,81 %
GENOTROPIN	810 374	-3,05 %	39,19 %
filgrastim	**2 029 366**	**-12,86 %**	**1,61 %**
ZARZIO	946 287	-7,40 %	46,63 %
NIVESTIM	794 047	-24,14 %	39,13 %
ACCOFIL	168 180	44,92 %	8,29 %
RATIOGRASTIM	119 198	-15,65 %	5,87 %
NEUPOGEN	1 654	-40,00 %	0,08 %
follitropin alfa	**1 898 790**	**11,16 %**	**1,51 %**
GONAL-F	1 520 410	12,48 %	80,07 %
BEMFOLA	378 379	6,15 %	19,93 %
epoetin zeta	**1 438 514**	**39,29 %**	**1,14 %**
RETACRIT	1 438 514	39,29 %	100,00 %
trastuzumab	**87 694**	**37,10 %**	**0,07 %**
HERCEPTIN	87 694	37,10 %	100,00 %

Appendix 3. Interview questions.

1. How would you evaluate following resources in Finland? Do these resources benefit Finnish pharmaceutical industry? Please explain.
   - the quality and quantity of human and knowledge resources
   - common infrastructure
   - natural resources
   - capital resources
2. How would you evaluate the level of rivalry in the Finnish pharmaceutical market? Does it give any advantage to Finnish pharmaceutical companies to compete in international markets e.g. strategy vise?
3. How would you evaluate the level of customer demand in the Finnish pharmaceutical market? E.g. does it benefit Finnish pharmaceutical industry by demanding constant improvement to products and services?
4. How would you evaluate the barrier to enter the pharmaceutical market as a new local company in Finland?
   a. Regarding sales and marketing?
   b. Regarding research & development and manufacturing?
5. Regarding pharmaceutical industry in Finland, do you think that related and supporting industries (e.g. co- operation with suppliers, universities and hospitals) give Finnish pharmaceutical companies any advantages to compete in the international markets?
6. In your opinion what kind of conditions the government/related authorities create for Finnish pharmaceutical industry to operate? How could the government support the industry more?
7. Which are the latest major changes in the competitiveness of Finnish pharmaceutical industry?
8. What kind of future development for Finnish pharmaceutical industry you expect in the next 10 years?
9. Could give your opinion about:
   a. What are strengths and opportunities of Finnish pharmaceutical industry?

b. What are the weaknesses and threats of Finnish pharmaceutical industry?

Appendix 4. Top 60 biggest pharmaceutical companies in Finland

		Sales € 2018	Grand Total
1	ORION PHARMA	316 095 282	316 095 282
2	MSD	168 907 700	168 907 700
3	ROCHE	120 140 628	120 140 628
4	PFIZER	118 676 028	118 676 028
5	RATIOPHARM	108 733 888	108 733 888
6	SANOFI	105 973 488	105 973 488
7	BAYER	99 110 593	99 110 593
8	NOVARTIS	97 501 232	97 501 232
9	GLAXOSMITHKLINE	94 807 888	94 807 888
10	TAKEDA	78 814 270	78 814 270
11	JANSSEN-CILAG	74 463 363	74 463 363
12	ABBVIE	67 478 116	67 478 116
13	NOVO NORDISK	66 199 790	66 199 790
14	BOEHRINGER INGELHEIM	64 361 269	64 361 269
15	GLAXOSMITHKLINE CONSUMER HEALTHCARE	60 950 861	60 950 861
16	ASTELLAS PHARMA	48 472 229	48 472 229
17	AMGEN	48 150 252	48 150 252
18	GILEAD	47 873 243	47 873 243
19	MYLAN FINLAND	46 060 436	46 060 436
20	ASTRAZENECA	45 915 963	45 915 963
21	ORIFARM	43 471 291	43 471 291
22	BRISTOL-MYERS SQUIBB	42 231 861	42 231 861
23	SANDOZ	39 961 224	39 961 224
24	MCNEIL, A DIVISION OF JANSSEN-CILAG	38 883 957	38 883 957
25	CELGENE	37 786 706	37 786 706
26	BIOGEN	34 626 863	34 626 863
27	PARANOVA	33 319 176	33 319 176
28	LILLY	29 146 667	29 146 667
29	VERMAN	27 270 907	27 270 907
30	CSL BEHRING	24 205 144	24 205 144
31	SHIRE	21 894 162	21 894 162
32	FRESENIUS KABI	21 675 338	21 675 338
33	UCB	20 254 847	20 254 847
34	SANTEN	19 130 195	19 130 195
35	SANQUIN	18 457 501	18 457 501
36	B. BRAUN	17 988 075	17 988 075
37	NUTRICIA MEDICAL	17 270 989	17 270 989
38	BAXTER	17 043 404	17 043 404
39	OCTAPHARMA	15 354 947	15 354 947
40	GE HEALTHCARE	14 564 515	14 564 515
41	ACO HUD	14 334 401	14 334 401
42	MERCK	13 903 287	13 903 287
43	LEO PHARMA	12 471 537	12 471 537
44	VIFOR PHARMA NORDISKA	11 294 082	11 294 082
45	MUNDIPHARMA	11 239 946	11 239 946
46	TILLOTTS PHARMA	10 721 036	10 721 036
47	STADA NORDIC	10 593 861	10 593 861
48	FERRING	10 399 322	10 399 322
49	BIOCODEX	9 418 838	9 418 838
50	ALLERGAN	9 154 858	9 154 858
51	IPSEN	9 141 937	9 141 937
52	GRIFOLS NORDIC	9 125 765	9 125 765
53	KRKA	9 050 228	9 050 228
54	SWEDISH ORPHAN BIOVITRUM	8 850 162	8 850 162
55	MEDAC	8 457 506	8 457 506
56	ACCORD HEALTHCARE	8 145 522	8 145 522
57	SABORA	8 101 806	8 101 806
58	SUOMEN BIOTEEKKI OY	8 032 462	8 032 462
59	RECORDATI	7 834 840	7 834 840
60	LUNDBECK	7 576 285	7 576 285