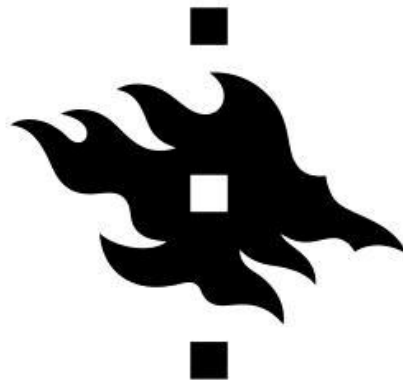




UNIVERSITY OF HELSINKI

Challenges and opportunities for business development in Finnish pellet
industries – Results on literature review and retailer survey

Master's Thesis

For the Examination of Master of Science (Agr. & For.)

Forest Products Marketing and Management

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Abstract The Finnish forest industries are going through heavy adjustments as especially the western world is moving towards a more digitalized model where the amount of paper and pulp consumed is diminishing. It is obvious that the whole industry is in need for new solutions. These new solutions and innovations can be found from the field of bioenergy. Finland is rich with forest-based raw material which can provide a long-term and local source of energy. In the future this will be of primary importance as the prices of the non-renewable energy sources will climb higher as the deposits of the fossil fuels dry up. The usage of the renewable energy sources are also very important in order to prevent the global climate change and to achieve the goals regulated for Finland in the Kyoto Protocol and the European RES-E directive. This Master's Thesis takes a look at the current state and the future trends of the Finnish wood pellet industries. The domestic wood-based pellet industries are studied with a concise literature review and a SWOT analysis based on the earlier literature. The analysis is linked to the future expectations and current retailer perspectives with a survey conducted between June and October 2013. The sample consists of 39 low, medium and high sales volume wood pellet manufacturers and retailers whom mostly do only domestic pellet trading business. Most of the strengths of the domestic wood-based pellet industries are related to different kinds of ecological aspects or different kinds of raw material related issues. In the future especially the prices of the raw materials, prices of other energy sources and prices of the end-product will be in a crucial role. Most of the survey participants underlined the significance of the governmental acts concerning the future of the whole business in Finland: a favorable taxing policy and different subsidies can make Finland truly a greener economy but this have not happened yet, much due to the unfavorable domestic politics. According to the survey respondents, in the future the demand of wood-based pellet services, especially tailored and ready-to-use services from maintenance to deliveries are going to increase.			
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Tiivistelmä/Referat Suomalainen metsäteollisuus on joutunut läpikäymään erittäin suuria muutoksia maailman digitalisoituessa ja tämän myötä paperin ja sellun kysynnän laskiessa. Tämän valossa on selvää, että koko metsäteollisuus tarvitsee uusia ratkaisuja. Näitä uusia ratkaisuja sekä innovaatioita voidaan tulevaisuudessa löytää bioenergian saralta. Suomi on metsävaltainen maa, jossa riittää uusiutuvaa raaka-ainetta, joka puolestaan voi tarjota pitkäaikaisen ja paikallisen energian lähteen. Tulevaisuudessa fossiilisten polttoaineiden hintojen noustessa ja varantojen ehtyessä tämä tulee olemaan ensiarvoisen tärkeää. Uusiutuvien energiamuotojen käyttö tulee olemaan myös erittäin tärkeää taisteltaessa ilmastomuutosta vastaan sekä tähdättäessä Kioton Pöytäkirjan ja eurooppalaisen RES-E direktiivin täytäntöön. Tämä Maisterin tutkielma tarkastelee suomalaisen pellettiteollisuuden nykytilaa sekä tulevaisuuden trendejä ja mahdollisuuksia. Kotimaista pellettiteollisuutta tutkitaan tiiviin kirjallisuuskatsauksen sekä tämän pohjalta työstetyn SWOT-analyysin perusteella. SWOT-analyysi linkitetään tulevaisuuden odotuksiin ja nykyisiin pellettijälleenmyyjien näkemyksiin kaupan tilasta kyselytutkimuksen pohjalta. Kyselytutkimus suoritettiin kesäkuun 2013 ja lokakuun 2013 välisenä aikana. Kyselytutkimuksen otos koostui 39:stä matalan, keskisuuren sekä korkean myyntivolyymin omaavasta puupellettien valmistajasta sekä jälleenmyyjästä, jotka suurimmaksi osaksi tekevät pelkästään kotimaista pellettikauppaa. Suurin osa kotimaisen pellettiteollisuuden vahvuuksista on liitoksissa ekologisuuteen tai erilaisiin raaka-aineisiin liittyviin näkökulmiin. Tulevaisuudessa erityisesti raaka-aineiden hinnat, muiden energiamuotojen hinnat sekä lopputuotteiden hinnat tulevat olemaan ensiarvoisessa roolissa. Suurin osa kyselytutkimukseen vastanneista korosti valtiollisten toimenpiteiden merkittävyyttä koko pellettiteollisuuden tulevaisuuden jatkon kannalta: suotuista verotuspolitiikka yhdistettynä erilaisiin tukiaisiin voi tehdä Suomesta todellisen vihreämmän kansakunnan, mutta pitkälti epäsuotuisan kotimaisen politiikan ansiosta tämä ei ole ainakaan vielä tapahtunut. Vastaajien mukaan erilaiset puupelletteihin liittyvät palvelut, kuten räätälöidyt ”avaimet käteen”-paketit joihin kuuluu kaikki palvelut huollosta toimituksiin tulevat nostamaan suosiotaan tulevaisuudessa.		
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LIST OF ACRONYMS

CO₂ Carbon dioxide

EU The European Union

R&D Research and development

IPCC Intergovernmental Panel on Climate Change

RES Renewable energy source

AEBIOM European Biomass Association

Mt Megatonnes

TWh Terawatt hour

CHP Combined heat and power

USA The United States of America

m³ Cubic meter

UK United Kingdom

METLA Finnish Forest Research Institute

TJ Terajoule

DHS District heating systems

FOB Free on board

CIF Cost, insurance and freight

mW Megawatt

kW Kilowatt

VTT Technical Research Centre of Finland

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Pyhtää,

January 9, 2014

Markus Joas

1. Introduction

1.1 The role of renewable energy in Finland and in the global business environment

Finland has throughout the history been highly dependent on forests. Traditionally forests have given shelter, material for building and the wooden biomasses have been utilized as fuel for heating and cooking purposes (Vahtola, 2003). The forest industry was one of the first drivers in the process of industrialization in Finland and ever since the sector has been an important part of the Finnish society and economy: in 2012 the forest industries accounted approximately 20% of all Finnish exports (Hetemäki et al., 2011; Niskanen et al., 2008; Tullihallitus, 2013).

Despite the fact that Finland is rich with wood-based raw materials, the whole forest industry is undergoing some rough times. In Finland, and also in the whole western world the consumption of pulp and paper products has already shown marks of decline or leveling off and the sector is in problems to ensure the profitability. Abreast with global challenges of forest industries, the need for new renewable biomass-based energy solutions is now higher than ever before as the global climate change booms. This brings new opportunities for forest industries, since when utilized in a sustainable, ecological and social way forests can provide a long-term and local source of energy and welfare. By these means the forest resources and forest biomass can be ensured to be present for the future generations almost unlimitedly as the trees grow via photosynthesis with sunlight and different agents from the soil. Trees capture carbon dioxide (CO₂) in the process (Röser, 2008).

The changes in global business environment affect also Finnish wood industries, especially sawmills. Typically pulp and paper industry has used the majority of the by-products from sawmills, but as the demand for pulp and paper products decline, the same happens also for the by-products such as cutter chips and sawdust (Mäkelä et al., 2011). The decline in demand of side-products of wood industries can be fixed by taking advantage of the tightening European Union's (EU) energy policies and the globally climbing prices of fuel and energy through making investments in the production of wood-based energy, for example in the pellet industries (Wan et al., 2012). These investments may improve the profitability of the sawmilling industry which has

lately been struggling with the Russian wood tariffs and overall recession of the world economy. In expansion to the heat and energy markets the pellet manufacturing could be a good choice for refining the by-products (Mäkelä et al., 2011; PELLETime, 2008).

In 2010 over 80% of the total primary energy supply of the world was conducted from non-renewable energy sources (IEA, International Energy Agency, 2012). As the global economy is heavily dependent on the non-renewable energy sources, for example oil, coal and gas, the whole world is in need for new methods for producing energy more sustainably. Eventually in the future the non-renewable sources will run out and before this happens the prices will be multiplied. It is also estimated that by the year 2050 there will be nine billion inhabitants in the world; this obviously sets pressure of its own for the challenges of the renewable energy sources. (Finnish Forest Industries, 2012; Röser, 2008).

During the recent years many of the forest companies have invested in research and development (R&D) concerning the bioenergy business. The internal company funding have been quite different what it used to be as the companies are seeking new ways to utilize wood. Both the pulp and paper industries and the sawmilling industry have been quite interested in the new bio-based solutions in order to create value added products (Toppinen et al., 2014). According to Pätäri (2009) biofuels are produced in Finland by larger forest companies but also by smaller players that are operating near the raw material sources. As stated by Toppinen et al. (2014) a lot of the large-scale western forest companies are bit by bit moving towards bio-based strategies. If and when the political uncertainty remaining in Europe at the moment will be set aside, many other forest companies will most likely to convert their strategies too.

The call for new, renewable energy solutions is even higher when considering the global climate change as a vast problem for the wellbeing of the environment and the humankind. The climate change is a natural phenomenon but the acts of man have been proved to accelerate this phenomenon unfavorably. According to Intergovernmental Panel on Climate Change (IPCC) the acts of humankind have affected the global average temperature and increased it (Le Treut et al., 2007).

In order to prevent and slow down the global climate change the Kyoto protocol was enacted in 1997 in order to control the global climate change (United Nations, 1998). The protocol became effective in 2004 when Russia ratified the contract. Finland, along with the other EU member

states ratified the contract in 2002. The countries that have ratified the protocol undertake to diminish their emissions of greenhouse gases. At the moment 191 countries have ratified the protocol. Every country has their own goals, but in general the agreement says that the participants have to diminish their emissions to a 5.2% lower level than the corresponding level of the year 1990. In addition, the EU has made internal decisions, and by these decisions Finland only has to cut the emissions to the level of the year 1990. Every participating country can decide on their own how they will cut down their emissions (Globalis, 2013; Ministry of the Environment, 2013; European Union, 2011).

The EU wants to promote the usage of renewable energy sources (RES) for protecting the environment and securing the European energy supply and enhancing the employment situation. For this the union established the RES-E directive where a total of 21% of gross inland energy consumption has to be of renewable origin. The EU countries have to set new targets according to the RES-E directive every five years and show what measures are going to be taken in order to achieve those targets (European Union, 2011b).

By the year 2020 the EU has also made an undertaking that 20% of the total energy consumption has to come from different renewable energy sources (Mäkelä et al., 2011). In 2005 in the European scale, bioenergy had a share of 66% of all the renewable electricity sources. The policy is directing for lowering the greenhouse gas emissions and by this enhancing the energy independency in the whole EU region and competitiveness of the European economies. The policy says also that by 2020 at least 10% of every member states final energy consumption in the transport sector must come from RES. The members that cannot achieve this 10% by their own are able to buy renewable energy from other members or sources outside the EU to avoid fines and legal actions. According to the European Biomass Association (AEBIOM) the usage of the pellets for heating purposes in residential, heating and industrial sectors could easily reach 50 megatonnes (Mt) in 2020 (FERN, 2012; Menegaki, 2012; AEBIOM - European Biomass Association, 2008).

The EU has also published a roadmap for enhancing a competitive, low-carbon bioeconomy by the year 2050. With this roadmap the aims are to lower the CO₂ levels by 80% in comparison to the corresponding levels of the year 1990 (Finnish Forest Industries, 2012). Despite the incentives, currently none of the European countries is using the full potential that they have in the wood-

based energy (Röser, 2008). Nevertheless, the energy policy is becoming critical in all European countries and the consumption should be governed into the direction of products made of renewable raw materials and by this lightening the waste burden that comes from the production of non-renewable products. The biggest drivers for utilizing bioenergy are the concerns about the climate change and the price advantage in comparison for the fossil fuels. With a sustainable energy policy the competitiveness of the forest industry can be enhanced and by promoting the usage of renewable energy sources the whole EU could achieve the climate objectives enacted in the Kyoto protocol and the renewable electricity RES-E Directive (Mäkelä et al., 2011; Peksa-Blanchard et al., 2007).

Traditionally the use of wood-based energy resources has been mainly local in the regions of consumption but this has been changing as a result of the Kyoto Protocol: the usage of biomass for energy gives credit only to the user, not to the producer. This makes for example the situation of Finland and Sweden interestingly different: Sweden is a major importer of pellets whereas Finland is a net exporter. This is why also Italy and Denmark have great interest in the pellet imports and by this trying to achieve the agreements made in the Kyoto Protocol (Peksa-Blanchard et al., 2007).

As forests and forest biomass can be seen as a carbon sink (absorbs more carbon than releases) and as an almost CO₂ neutral option for energy production many of the EU Member States have chosen to enhance the biomass utilization in order to achieve the goals of the RES-E Directive and the Kyoto Protocol. By these targets also the demand for wood-based pellets is increasing. For example, Finland has set a two terawatt hour (TWh) target for pellet consumption in 2020. Some of the member states have conducted subsidies such as grants for households for enhancing the pellet adaptation by new pellet equipment. Therefore the pellet markets are undergoing some rapid changes and this has made the pellet market more interesting for outside investors (Mäkelä et al., 2011; FERN, 2012).

The wood-based biofuels can be divided in three groups according to their physical form: liquid, solid and other wood fuels. The liquid wood fuels are, at the moment, mainly black liquor, a by-product of the pulp industry. Another promising source as a liquid wood fuel is pyrolysis oil. It is produced by heating the wood rapidly to 500-600 degrees and by this making it to evaporate into gases. When these gases cool down they become pyrolysis oil. In the future this oil could be

applied also in the transportation as a fuel. The solid wood fuels consist of wood fuels used by combined heat and power production (CHP) and the small-scale usage of wood as energy in residential, commercial and office building heating. Solid wood fuels also include logging residues like forest chips and forest industry's by-products like bark and sawdust. By this segmentation also the pellets and briquettes are considered as solid wood fuels. Additionally some other wood fuels are also utilized for energy production. These are mainly by-products or leftovers from the forest industries, such as methanol, biosludge, tall oil and used wood from demolition. One should also bear in mind that the bioenergy may only be called renewable if the biomass growth is larger than the harvest and also that the total CO₂ emissions during the production, transportation and processing is smaller than the biomass have captured during its life-cycle (METLA, 2011; Häyrynen, 2006; FAO, 2008).

Conceptually biomass becomes biofuel when it is traded for energy use or when it is consumed in energy production. Currently the most important products that are traded for energy purposes consist of, for example, wood pellets, ethanol, vegetable oils, charcoal and fuel wood. In the future a common trend will be the usage of palm oil for biodiesel to be used in the road transport. In the Finnish scale also peat and black liquor (by-product from the pulp and paper industry) are widely used for energy purposes. Black liquor is mostly utilized in the energy process of the pulp mills (Heinimö, 2008).

Despite the rapidly changing biofuel markets, the statistics of international trade often lag behind since there are no international organizations compiling new statistics on a regular basis. The compiling of the statistics is complicated because a lot of the biomass is essentially traded for material purposes and can have several end-use purposes. Also the recording of the statistics can be problematic: for example the EU records wood-based pellets under the same code as wood waste. This makes the recording of the wood pellet volumes hard. The updated statistics would be of importance for market actors, policy makers and other stakeholders for developing the whole biofuel market area (Heinimö, 2008).

Whereas the residential pellet markets are normally local with regional and domestic trade, the industrial wood pellets trade is highly characterized by large, global bulk volumes. In 2012 Scandinavian countries, together with the United States of America (USA) and Canada were the biggest producers of wood-based pellets. The second biggest group of producers consists of many

EU member states, such as Austria, Germany, Italy, Estonia, Latvia, Poland, but also Russia. Also the emerging producing regions and countries such as Australia, South America and South Africa have been gaining ground. The world production volume of wood-based pellets in 2010 was approximately 14 million tonnes (Verhoest & Ryckmans, 2012).

Consecutively it can be said that three different types of markets for wood-based pellets have developed in Europe. The first one is the case of pellet markets that are dominated by the mass utilization in the power plants – this is the situation in the Netherlands and Belgium, also the United Kingdom (UK) is moving towards this scenario with the co-firing applications. The second type of markets combines all of the scales of usage – small, medium and large – as in the case of Sweden and Denmark. In the third case the pellets are mostly utilized in small-scale for residential heating purposes. In this third type of utilization the pellets can be used in boilers or in stoves. The type of the pellet market usually defines also the form of usage and distribution: the USA and Italy, both rich with pellet stoves, use and distribute most of their pellets in bags, but for example in Austria and Germany the bulk deliveries are the most common ones (AEBIOM - European Biomass Association, 2008).

According to Verhoest & Ryckmans (2012), Canada seems to have by far the largest potential for pellet production: in 2010 the installed production capacity was about 2.1 million tonnes and within the next three years it is expected to reach 3.6 million tonnes. The largest market for wood-based pellets is Sweden and the trends show that it will remain the largest in short term. As stated by Selkimäki et al. (2010) in Sweden mainly three factors affecting the vastness of the pellet sector have been identified: good availability of the raw material, a favorable taxation system for biofuels and extended district heating networks. Also the pellet markets are highly developed with large trade flows after decades of enhancement. The next biggest market areas are mainly found from Europe, including Austria, Italy and Germany (Verhoest & Ryckmans, 2012; Peksa-Blanchard et al., 2007).

Many of the market areas can be seen as export-driven: Canada, Poland, Finland, Russia and the Baltic States all have low internal sales which make the exporting obvious (Peksa-Blanchard et al., 2007). According to Verhoest & Ryckmans (2012) in 2012 the Russian pulp and paper company Vyborgskaya Cellulose started production at its new wood pellet plant which has a capacity of 900000 tonnes per year making it the biggest pellet production facility in the world. The plant

located near the Finnish border in the western Russian city of Vyborg represents a substantial rise in global pellet production but also in the Russian pellet exports. This plant, along with the other major facilities in Russia can also ease any short-term shortages of wood pellets within the EU member states (Sikkema et al., 2011).

Despite the growth the European pellet markets are prevailed by surplus. The market prices of large-scale users are too low for the European pellet producers and they are struggling with relatively high raw material prices as well. The transatlantic cargo-shipped pellets have gained ground because of the cheaper prices (VAPO Oy, 2012).

Wood-based pellets play an important role in the European process of emission mitigation and the usage in household heating has been promoted with subsidies and harder taxing of the fossil fuels. In larger scale pellets are normally used along with other fuels, such as coal. For example the Italian boom in sales of pellet fireplaces and the English incentives for renewable electricity production have made the demand for pellets higher (VAPO Oy, 2012).

Almost 40% of the roundwood handled eventually become residues that are applicable as wood-based energy (Ericsson et al., 2004). Theoretically considering the sawdust residue potential for bioenergy usage of the whole world could be as much as over 300 million cubic meters (m³); a great deal of this residue flow comes from the USA, Canada, China, Brazil and Russia. Despite this, one should bear in mind that also the particleboard and fibreboard manufacturers are competing for the raw material, mainly for the sawdust. Also should be noted that generally the raw material, cutter chips and sawdust, are utilized in such an efficient way that new alternatives for raw material of pelletizing will be needed in the future to ensure the growth of the pellet market (Peksa-Blanchard et al., 2007; Selkimäki et al., 2010).

Despite the different incentives, the high costs of investments are typically the biggest obstacle to small-scale CHP production, as it is also for the investments in the pellet production industry (Mäkelä et al., 2011). Nevertheless, it can be said that the different incentives in the EU member states have glaringly worked: the European demand for the pellets is the highest in the world and the consumption has steadily increased from the 3.8 million tonnes in 2005 to 9.8 million tonnes in 2010. The consumption is expected to double by 2020 up to 24 million tonnes (Verhoest & Ryckmans, 2012). This is mostly due to the expected growth in the industrial usage, but as mentioned before, the industrial and residential wood pellet scenes are slightly divergent:

especially the quality requirements are different. Whereas the residential pellet has to be of premium quality the industrial pellet can be slightly poorer. The quality of the pellet is mostly determined by the combustion technology and the logistics facilities (Verhoest & Ryckmans, 2012).

There has been a big debate concerning the production of some bioenergy, especially the biofuels: for example the palm oil cultivation often takes place in clear-cut rain forests causing higher greenhouse gas emissions than fossil fuels. The cultivation competes from the land area also with cereals cultivated for human and animal feed (UNEP, United Nations Environment Programme, 2009). The usage of the wood-based bioenergy normally does not compete with the cereals or rain forests for the utilization of the cultivated land as the other biofuels that are produced for example from cereal-based products or palm oil. Also the ash produced in the refinement of wood is a good fertilizer that could be used more in favor of forest cultivation (Metsäteollisuus, 2012; UNEP, United Nations Environment Programme, 2009).

Although considered as an ecological source, also the wood-based pellets have been criticized about the lack of sustainability as the European Commission has not decided on a framework for biomass sustainability. Despite the lack of the framework many EU member states, such as Belgium and UK have specified their own standards. Also the main industrial users of wood pellets decided already in 2010 to specify the minimum requirements for bulk wood pellets (Verhoest & Ryckmans, 2012).

1.2 Wood pellet production and trade in Finnish and international context

The Nordic countries, including Finland, have considerable resources of forest areas. The Finnish total land area is 30.4 million hectares and even up to 26.1 million hectares of the land area consist of forestry land. The forestry land is divided into forest land (20.3 million ha), scrub land (2.5 million ha) and waste land (3.2 million ha). Additionally also the forest roads etc. (0.2 million hectares) can be counted as forestry land (METLA, 2011). This is the biggest reason why the country has long traditions in utilizing the biomass for energy purposes and biofuels, especially wood fuels play an important role in the modern Finnish energy scene. When considering the

harsh environment and especially the long winter of Finland and other parts of the northern Europe should be noted that the usage of the wood-based pellets in the residential heating purposes can significantly reduce the electricity price spikes and especially the dependence on oil and gas imports (Ericsson et al., 2004; Hakkila, 2006; Heinimö, 2008).

11.9 million hectares (46%) of the total forestry land is located in Southern Finland and the rest, 14.2 million hectares (54%) is located in Northern Finland. Although the share of the Northern Finland is a little bigger, it only adds up as a third of the total tree stand capacity of the country. This is due to the harsh conditions of the arctic region (METLA, 2011).

According to the recent stocktaking of Finnish Forest Research Institute (METLA) (2011) the total growing stock in Finland in 2011 climbed to about 2284 million m³. On average the growing stock of forestry land per hectare is about 110 m³. The annual increment of the Finnish growing stock has been positive since the 1970's: analyzing the situation from the beginning of the 20th century, the increment has been over 60%. This means that every year the Finnish wood resources are getting bigger. By this, with a way of sustainable forestry, intensive R&D, high level of know-how and effective wood energy programs there will be a lot of capacity for the whole Finnish forest industry, including the developing sector of bioenergy (METLA, 2011; Lamberg & Peltoniemi, 2010). In many developing countries the forest areas have been largely threatened by the bioenergy needs as increment in the population, agricultural expansion and unsustainable forest management practices boom. This was also the situation in Finland during the earlier centuries, but nowadays, as described above, the situation of forest areas has been stabilized and well-managed (FAO, 2008).

According to Heinimö (2008), in Finland the usage of biofuels has been vast mainly due to the strong forest industry sector. Also firewood has traditionally been important in residential heating. Almost 40% of the roundwood handled by forest industry eventually become forest residues that are applicable as fuel after upgrading into for example pellets or as raw material in the wood fibre industry. In the future the felling residues, such as tops and branches will represent a large potential (Ericsson et al., 2004).

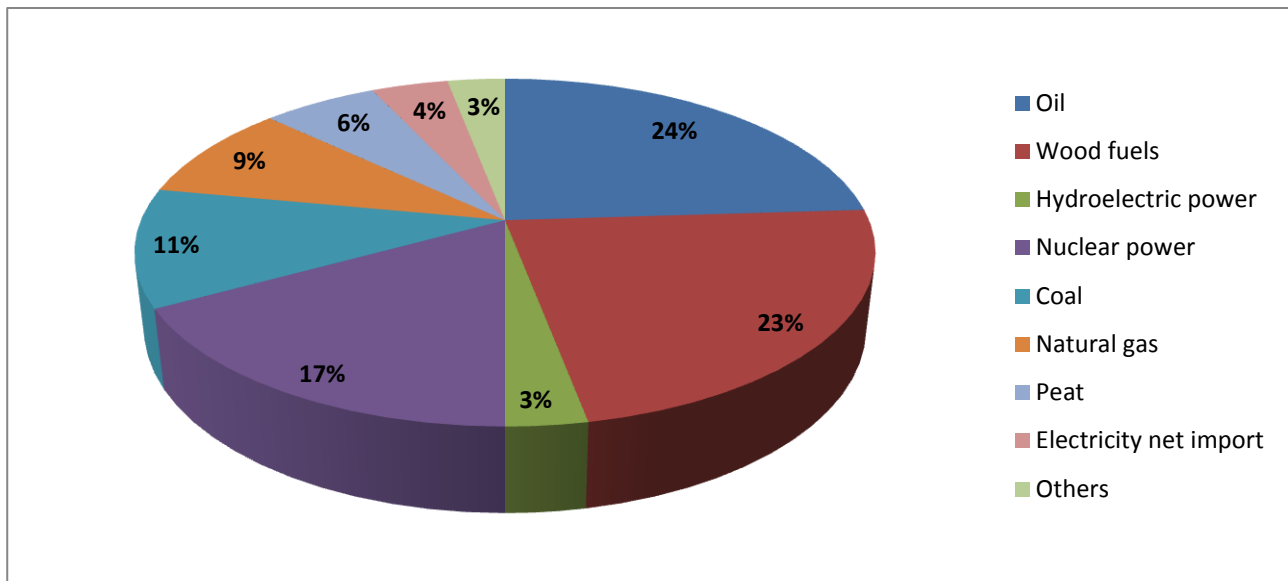


Figure 1: The total energy consumption in Finland in 2011 (Statistics Finland, 2011b)

According to Statistics Finland (2012) the total energy consumption of Finland decreased in 2011 approximately 5% from the year before, being 1.39 million terajoules (TJ). The CO₂ emissions of energy production and usage in 2011 were 51.7 million CO₂ tonnes indicating a decrease of 12% compared to 2010.

As can be seen from Figure 1, the imported, non-renewable fossil fuels – oil, coal and natural gas - have a significant role in the Finnish economy and energy field. In 2011 they covered, respectively, 24%, 11% and 9% of the total domestic energy consumption. In 2011 the usage of fossil fuels decreased 12% (Statistics Finland, 2012).

Despite the large use of fossil fuels, Finland is the leading bioenergy consuming country in the world with Sweden and the usage of wood as energy resource has its roots long in the history. The wood-based bioenergy usage adds up for about 23%, approximately 100 TWh in the whole domestic energy utilization (Statistics Finland, 2012). The Figure 1 illustrates that wood fuels are the second biggest form of energy in Finland after the oil products. The wood fuels are mainly collected from the vast forestry land areas as forest biomass along with the commercial roundwood. Lately also some special energy forests have been established, although this form of cultivation is still not usual in Finland (METLA, 2011; Röser, 2008; Statistics Finland, 2012; Rissanen, 2008).

Finland, poor in other natural resources, is rich concerning the forest resources and mainly this is why the forest industry has played such an active role throughout the Finnish history of industrialization. The forests can be seen as energy sources, from which the energy can be transported or restored either straight from the source or modified, the same way as from oil and gas fields, coal mines or the sun (Bröckl et al., 2010). The only notable domestic energy resources consumed are wood fuels, peat, hydroelectric power and wind energy. In 2011 they covered, respectively, 23%, 6% and 3%. The usage of wind energy is of minor role and is situated in the section "Others" with 3% of the whole section in Figure 1. In 2011 the usage of renewable energy sources decreased 1%. Finland also imports electricity, mainly from Russia and Scandinavia. In 2011 the import accounted 4% from the total energy consumption (Statistics Finland, 2011b).

Concerning the usage of biofuels, the forest industry also plays a major role: approximately 64% of the energy demand and usage of the whole industry comes from wood-based products. This means mainly internal by-products, and for example sawmills by using bark and sawdust are practically self-sufficient with energy. They provide the raw material also for district heating systems (DHS), households and others (Ericsson et al., 2004).

As mentioned earlier, the EU has set some strict goals in diminishing the pollution to the atmosphere. The forests and biomass-based energy sources can help Finland to achieve these goals. Primarily all of the biomass used in Finland for energy is originated from the forest, and this makes the forest industries, but also the forest owners of Finland, major players in the global biofuel market (Ericsson et al., 2004).

Despite the booming European markets it can be said that Finland is taking the first steps concerning the pellet scene. The competitiveness is still lagging behind domestically but the levels of awareness and interest are getting higher; for example the Finnish Broadcasting Company YLE reported in January 2013 that the local Finnish small-scale producers are producing more and more wood-based pellets. This is due to the substantial oil price advance, and many residential users have converted their old oil heating systems into the cheaper wood pellets. According to YLE many have also said that a big reason for the crossover are the ease of use, the domestic origin of the raw material and the low carbon foot print (YLE, 2013).

The markets are still in an early phase with very low market penetration but there can be seen some marks of dynamic growth. This is good, because as many European markets have shown,

with the proper conditions towards the pellet energy, the usage of pellets can grow rapidly. For example according to the AEBIOM the market of pellet stoves grew from zero to over 250000 stoves sold per year in only a decade (Rissanen, 2008; AEBIOM - European Biomass Association, 2008).

Table 1: Wood pellets in Finland 2001-2011 (METLA, 2011)

Year	Domestic production	Small-scale housing and farming	Large buildings, CHP	Total	Exports	Imports
	1000 tonnes	1000 tonnes	1000 tonnes	1000 tonnes	1000 tonnes	1000 tonnes
2001	75	-	-	15	60	-
2002	126	-	-	24	97	-
2003	166	15	25	39	127	-
2004	190	21	26	47	157	-
2005	192	23	31	55	194	0
2006	259	57	31	87	193	0
2007	326	61	56	117	186	0
2008	373	81	70	151	227	10
2009	299	62	94	156	136	50
2010	290	74	96	170	191	18
2011	308	68	109	178	136	14
Change 2011/2010, %	6	-8	14	4	-24	-19

As seen in Table 1, in 2011 pellets were produced domestically approximately 308,000 tonnes, which was 6% more than in 2010. The all-time highest amount of pellets produced in Finland was set in 2008 when the quantity was as high as 373,000 tonnes. Traditionally the Finnish pellet market has been export-oriented but in 2011 the exports declined 24% from the year before adding up to 44% as exported from the total production; the total amount of export in 2011 was 136,000 tonnes. A year before the export rate was 62% of the total wood pellets produced. In 2011 almost all of the exported pellets were transported to Denmark and Sweden. The amount of exports to Denmark added up to 73%. At the same time the domestic usage grew 4% from the year before, adding up to 178,000 tonnes in 2011: this account as the all-time highest domestic usage figure in Finland. From the domestic usage approximately 60% was targeted to CHP's and

larger properties. Whereas the domestic usage has showed marks of increase the imports have been decreasing as larger amounts of the Finnish pellets are directed into the domestic markets. Altogether pellet imports in 2011 were 14,000 tonnes which means a decrease of 19% in comparison to year 2010. Of all the imported pellets a majority, 90%, came from Russia and the rest mainly from Sweden and Denmark (METLA, 2011; Finnish Forest Industries, 2012b).

Much of the increment in the domestic usage accounts for the bigger-scale usage of pellets in the large buildings and CHP's: in 2011 this mode of usage rose 14%, to 109,000 tonnes whereas the small-scale usage diminished 8%, accounting as 68,000 tonnes. The total domestic consumption in 2011, including the imports, was 192,000 tonnes (Finnish Forest Industries, 2012b).

The domestic usage of the pellets has been rising year by year, but not as strongly as the sector hoped. A good sign for consumption maybe the rising demand for the pellet equipment as happened in 2012. Currently there are some 26,000 small-scale houses that are utilizing the wood-based pellets for energy purposes. The majority of the pellet equipment in these houses have been converted from oil heating systems via renovation. Although the small-scale building in Finland has long traditions, nowadays the new houses are mainly prefabricated; this is not in favor for the pellet systems as the equipment are still not marketed nor produced as easy-to-sell packages (Tuohiniitty, 2012).

The fact that Finland along with several other European countries are currently using pellets only a minimal and extensive amount is due to policies that are supporting the current market development: the new energy technologies cannot penetrate the existing markets without significant political support. Normally the lobbying power and existing barriers of the fossil fuel industries are too strong for a market driven penetration (AEBIOM - European Biomass Association, 2008).

One big reason for pellet industry to lag behind is the fact that all levels of society are still lacking awareness regarding the role of bioenergy. According to AEBIOM (2008) the main problems to enhance the knowledge towards the wood pellet based heat and energy production are that the EU still does not have enhancing legislation and the small and young industry does not have enough capacity to inform potential customers about the superiority of the product the same way as for example the oil companies. Also the awareness should be increased especially among the industry-related professionals, such as construction industry, architects, installers etc. As a

solution for these problems AEBIOM suggests publicly funded communication programmes and studies to highlight the economic and ecologic impacts of different energy solutions (AEBIOM - European Biomass Association, 2008).

A major enhancement in Finnish legislation took place in July 2012 when the construction regulations were converted into primary energy coefficient model. With the concept of primary energy is meant the energy that is included in the natural resources before the first exploit, the energy that can be utilized from the source. The primary energy has not been converted or transported. Primary energy can be found in several different raw materials such as oil, natural gas, peat, wood and uranium, coal, running water, wind and solar radiation. Key issue is that the sources can be converted into energy with various methods and that it can be traded. The primary energy coefficients are defined with different calculations and methods with different raw materials; there is no universal unambiguous definition (Tuohiniitty, 2012; Bröckl et al., 2010).

Table 2: Total primary energy coefficients of the most common forms of energy (Bröckl et al., 2010)

Form of energy	Coefficient
Electricity	2.0
District heating	0.7
District refrigeration	0.4
Fossil fuels	1.0
Renewable fuels	0.5

As can be seen from Table 2, this new method gives a good energy coefficient for the renewable fuels, also for the pellets and will hopefully have a positive impact in the crossover from non-renewable energy to the pellet system. This crossover will lift the resale value of small-scale buildings since the new regulations are likely to demand a certain energy certificate also from the older buildings. Despite the new model it should be noted that the energy solutions are always weighted also via other variables such as the investment and operating costs (Tuohiniitty, 2012; Bröckl et al., 2010).

The price development of the pellets has been quite stable already for three years, whereas the prices of other energy sources have been rising. In the beginning of the millennium the price development was also quite stable, but in 2005 a clear elevation in the wood pellet prices took place. This elevation was due to higher raw material costs and the fact that many of the pellet producers started to utilize also the moist raw materials in the pelletizing process. The costs of the drying process were transferred straight into the consumer prices. Although the prices went up in 2005, it can be calculated with the present day prices that the life cycle heating costs in a small-scale building including the investment and operating costs for 20 years are approximately 7-10 cents/kWh. With these prices the pellet solution can be seen as an energy efficient alternative even for heat pumps (Tuohiniitty, 2012; Tuohiniitty, 2013).

The average export price (FOB) of wood-based pellets in 2011 was 127 €/tonne and the Finnish export of pellets added up to 17 million euros. In comparison the average import price (CIF) at the same time was 148€/tonne. In January 2012 the average price of pellets were 30.23 €/mWh, which is 0.80 euros more than at the time corresponding in 2010 (Finnish Forest Industries, 2012b).

As said earlier, in 2011 the Finnish pellet market growth was modest, and VAPO Oy was the biggest producer of pellets with a market share of over 50%. Other big actors include Versowood and StoraEnso. The retailer chains also vary from small-scale retailers to bigger, nation-wide chains such as Agrimarket and K-Rauta. Lately the actors in the pellet sector have been obliged to adjust their production because of the lack of raw materials. For example VAPO Oy shut down three pellet mills in Finland in late 2011: the heavily unprofitable mills of Ilomantsi, Haapavesi and Kaskinen had to close their doors. Also the exports to Scandinavia and Central Europe have been unprofitable mostly because of the high costs in transportation and raw materials but also because of the strong exchange rate of Swedish crown. Neither the demand nor the business environment (taxing policy and politics for supporting) have not developed in the desired direction. According to VAPO Oy despite the heavy adjustment operations the future of pellet industry in Finland is seen troubled as the world wide surplus is expected to continue and the prices of raw material will remain high (VAPO Oy, 2012; PELLETtime, 2008).

Although the taxing policy development has not been quite what the industry desired and some pellet mills have been closed down, there are also some enhancements made by the Finnish

government towards more sustainable energy consumption: the energy taxation system changed in 2010. Since this change the larger users, especially the energy corporations have been replacing the usage of oil and natural gas with pellets. For example Tampereen Energiantuotanto Oy in southern Finland constructed a 33 megawatt (mW) pellet heat plant, also Suur-Savon Sähkö Oyj is building a seven mW pellet heat plant. Also Helsingin Energia started to run tests for co-utilization of coal and wood-based pellets. These plants generate energy from the pellets via dust combustion. The operators could also use woodchips but they have stated that although the pellets are a bit more expensive, the process is more stable and does not require as much maintenance as woodchip combustion. The pellet producers have been satisfied by the new large-scale consumers since this brings more stability into the business. The new and improved logistics could eventually help also the small-scale consumers (Tuohiniitty, 2012; Helsingin Energia, 2012).

The main marketing tool for enhancing the domestic usage of pellets have traditionally been the low prices but also this has been altering lately due to the higher and rising raw material prices. A great unutilized market potential can be found in the pellet sector, but at the moment the lack of subsidies for converting into pellet heating system is slowing the establishment of new small-scale boilers (Selkimäki et al., 2010).

Also the need for European standardization is acute: currently a new European standard CEN 335 for pellets is under construction, and time shows if this will fulfill the needs of the market (Loibnegger, 2011; Becher et al., 2007; PELLETime, 2008; AEBIOM - European Biomass Association, 2008). Until the recent the main producers have been following the Swedish standards for pelletizing because the majority of the pellets are ultimately exported to Sweden. In 2002 also the Bioenergy Association of Finland was developing a new standard system for the domestic pellet production but stopped it and decided to concentrate on the European level. Currently the European Standard for solid biofuels CEN/TS 14961 has been set to have an impact on the European solid biofuels industry (Loibnegger, 2011; Becher et al., 2007; PELLETime, 2008).

1.3 Motivation of the study

The forest industry has been one of the backbones of the Finnish economy for centuries until the recent: the Finnish forest cluster has gone through some heavy adjustments and since 2005 the production capacities of paper, cardboard and wood product industry have diminished approximately 20% (Hetemäki & Hänninen, 2009). Also the situation of wood material imports has been altered due to the heavy export duties and tariffs of the Russian imported wood. Obviously the heavy worldwide economic recession and the ongoing technological revolution have also affected widely the Finnish forest cluster. It is not exaggerated to say that the whole industry is going through one of the roughest times in the history and sets pressure for new kinds of innovations (Hetemäki & Hänninen, 2009; Kuisma, 2008; Verhoest & Ryckmans, 2012).

According to Hetemäki & Hänninen (2009) the Finnish forest industry utilized wood as much as 75.4 m³ in 2007. They have estimated that the wood utilization of the Finnish forest industry will diminish to 51.4 m³ in 2020. As a consequence also the utilization of the by-products of the forest industries for energy production will diminish. Hetemäki & Hänninen (2009) have also stated that this would mean 7 million m³ / year more of pulp wood and by-products for energy utilization, such as pellet production.

In the future the price development of the emissions trading business is likely to direct more of the pulp wood and the by-products of the forest industries to be used for energy production. Also the EU has set a goal for Finland that the amount of renewable energy in final consumption should be 38%. In the calculations a big proportion of this figure is relied on the usage of black liquor as renewable energy (Hetemäki et al., 2011; European Union, 2011b; Wan et al., 2012). Along with the diminishing production of the forest industries also the amount of black liquor used is decreasing. In the future this can create a new kind of concern for the domestic and European energy politics, but this can make new room also for the Finnish pellet industries and other bioenergy solutions. In addition, the rising prices of the traditional energy, such as oil and coal, are directing the focus towards the renewable sources of energy (Hetemäki & Hänninen, 2009; Hetemäki et al., 2011).

The research of the pellet industry has been quite modest in Finland and this study wants to lighten up the consumer behavior of the pellet buying process in order to get more knowledge for

the actors of the whole domestic bioenergy cluster. The Finnish pellet industries have been mostly researched from the macroeconomic viewpoint of the industry, but this study takes a closer look to the microeconomic side: what aspects do the different pellet retailers and manufacturers value and how these aspects can be helpful in the future. Especially the consumer perspectives, the psychology and the perceptions along with other factors affecting the purchase decisions of the final consumers have not been studied at all. The knowledge of the consumer decisions will be helpful in order to make the wood-based pellets a reasonable bioenergy solution for bigger masses in Finland.

Along with these facts and other political instruments, such as feed-in tariffs and subsidies, it is obvious that the domestic wood consumption can be directed more into the bioenergy usage. After all, the domestic wood pellet production is a great business opportunity for the Finnish companies. It is also important for the regional economy especially in the more rural parts of the vast country.

2. Purpose and implementation of the study

The main driver behind this study is to explore the external structures affecting the pellet trade in Finland and the whole scene of Finnish bioenergy business, more precisely the emerging markets for wood-based pellets in Finland. The aim is to make conclusions behind the consumer motivation for the pellet consumption and draw some conclusions of the factors.

The pellet markets have been booming in many European countries and pellet itself has become an important fuel. This still has not happened fully in Finland. This study tries to lighten up the biggest motivators and lacks in the marketing and implementation of pellet as a source of energy. Based on the experience gained, the study gives recommendations for developing the overall image and consumer sales of the wood-based pellets.

The study takes a look at the external operational environment of the business: what are the strengths and weaknesses in the pursuit of increasing the domestic wood-based energy usage, what kinds of problems lies ahead with other industries, customers, strategic choices and raw material supply, how do these factors affect the whole pellet industry in Finland and how these results can be applied in managing additional value for a company. The study also takes a look how the domestic pellet industry could improve their business opportunities in the Finnish wood pellet markets and how this could be implied in order to improve their competitive positions among the domestic pellet users.

As mentioned earlier, research has been done concerning the external operational environment of the pellet companies, but in comparison the consumer markets have been studied only a little. The lack of this kind of research and filling this gap has also been a major driver behind this study.

The purpose is to answer the following questions:

- *What are the strengths, weaknesses, opportunities and threats of the Finnish pellet industries?*
- *What are the customers' opinions on external factors in the business environment and marketing solutions that affect the Finnish wood pellet trade now and in the future?*

- *What kind of retailer chains and marketing solutions would be the best for the different wood pellet manufacturers?*

The aim is to find out what kinds of values the small, medium and large pellet retailers and producers respect and to make a thorough analysis and conclusions based on them. One aim is also to find real marketing channels and viewpoints for new strategic implementations. The main structure of the study follows “The Funnel Model of the planning process” by Juslin & Lindström (1998). This model is introduced in the Figure 2 and is applied throughout the whole study and used as a map for guidance, and it also lays the basis for succeeding in this research.

In the beginning of the study a thorough problem analysis has to be done. The problem is clarified, a picture is created and shown why this research has to be implemented. The whole subject is clarified with a precise literature review (Cooper, 1998). The motivation is created while familiarizing the subject and describing what knowledge is needed. After the matter to be studied is clarified, the specific purpose for the study can be given and the exact objectives specified (Juslin & Lindström, 1998).

In the part of the theoretical framework and literature review the possibilities for solving the problem and existing knowledge of the matter being studied are presented. This phase gives the study a clear and logical structure, but also the root of the next steps and an outline is clarified. By this also theory and reality are made to correlate (Juslin & Lindström, 1998).

After a concise framework and literature review has been made, the framework has to be operationalized from theory to the empirical level: this makes the grounds for primary data collection which in this study is conducted by a questionnaire sent to the retailers of wood pellets. Finally the data is analyzed by using various analytical methods (Juslin & Lindström, 1998).

In addition the methods, main data sources and definitions of the study are introduced. This study focuses on analyzing the Finnish wood pellet markets. Finally, conclusions are drawn and recommendations based on the findings of the study are given.

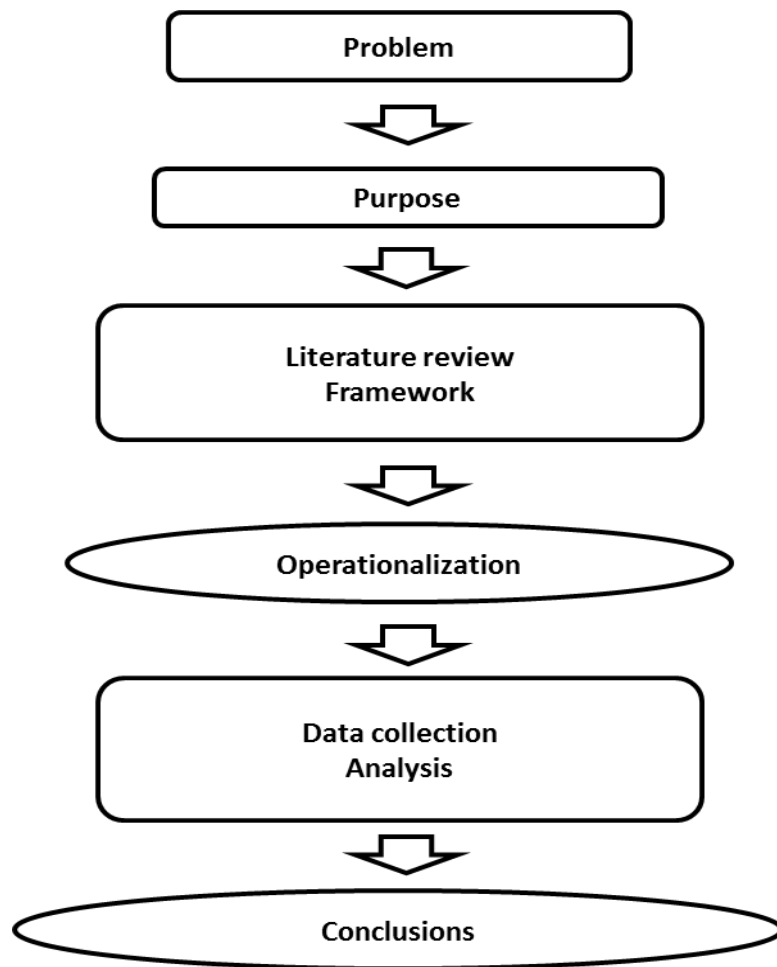


Figure 2: The Funnel Model of the planning process (Juslin & Lindström, 1998)

3. Empirical literature review on wood-based pellet manufacturing and characteristics of trade of the wood-based pellets

3.1 Technical qualities and manufacturing process of the wood-based pellets

Pellets are a modern type of densified biofuel processed from the dry by-products of the mechanical forest industry. The pellets were patented by Rudolf Gunnerman, a German researcher living in the USA after the first oil crisis in 1976 with the brand name “Woodex” (Tuohiniitty, 2012). The pellets are easy and quick to produce and they are mainly compressed from spruce and pine cutter chips, wood chips and sawdust to a usually cylindrical form of 6-12mm of diameter and 10-30mm of length with broken ends. Also fresh sawdust, peat and recycled wood can be used for pelletizing. All of the materials used have to be pulverized before compressing. The total moisture content of the end product is low, approximately 10% and the volume is approximately 650 kg/m³. The low moisture content makes the combustion efficiency very high (Rissanen, 2008; PELLETime, 2008; Alakangas, 2009). Because of the compressing the final product is of high density and therefore contains higher energy levels in comparison with the unprocessed biomass. The heat value of a tonne of wood pellet is high, approximately 4.9 mWh: it is equivalent to 4 stacked m³ of firewood or 450 litres of oil (Hansen et al., 2007). According to Statistics Finland, wood pellets belong to the group of biomass-based energy sources, i.e. to the biofuels. This makes the count of CO₂ emissions of wood pellet combustion almost neutral in calculations (Statistics Finland, 2011b).

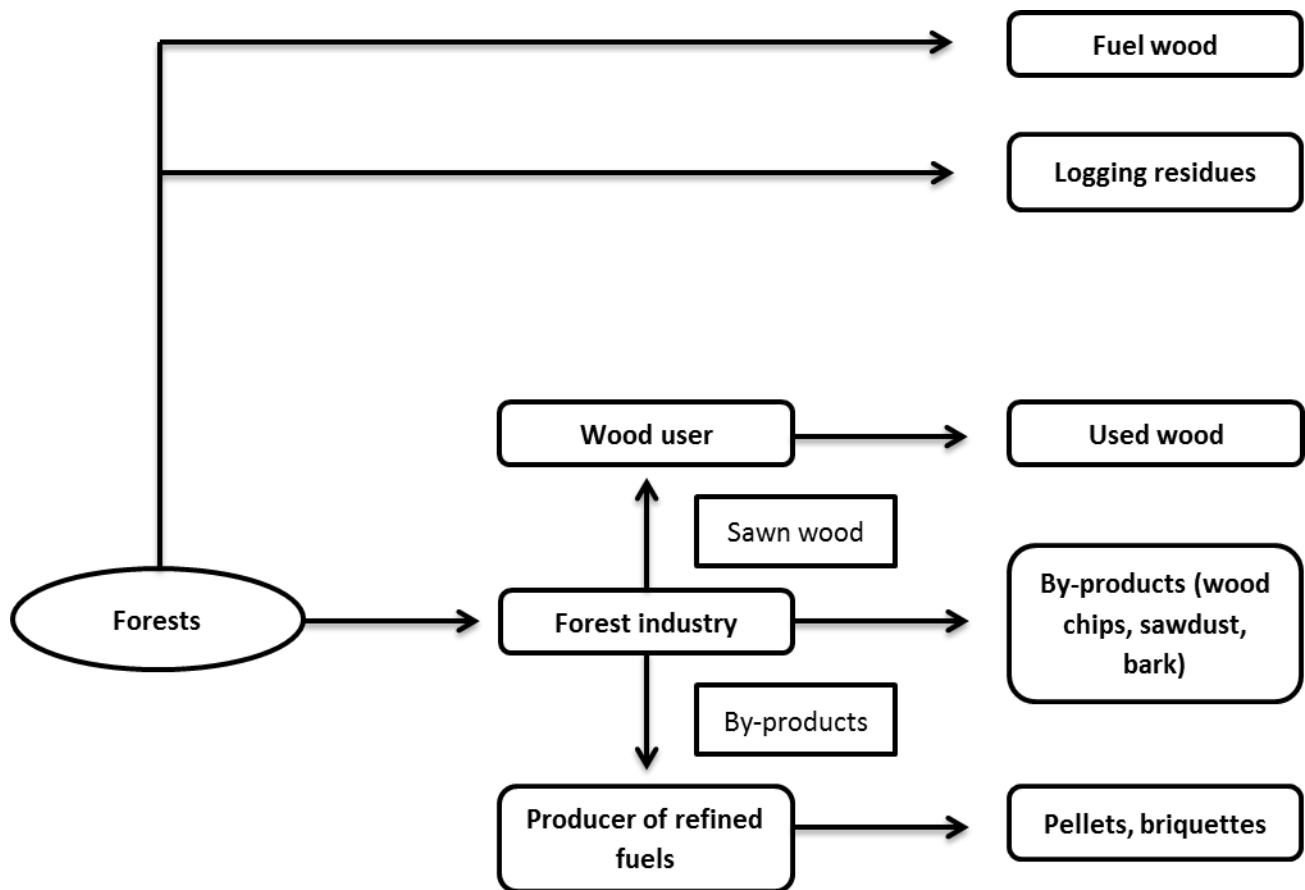


Figure 3: The supply of wood fuels from forests (Ericsson et al., 2004)

Pellets can be seen also as energy carriers the same way as briquettes or an oil barrel: pellet is a phenomenon that can be used to produce mechanical work, heat and physical processes. They are in an essential key role as a technology for increasing the utilization of the biomass for energy in Europe (Bröckl et al., 2010; AEBIOM - European Biomass Association, 2008).

Table 3: Key characteristics of wood-based pellets (AEBIOM - European Biomass Association, 2008)

Heating value	2 tonnes of pellets = approx. 1,000 litres of heating oil
Water content	In the final product below 10%
Ash content	Below 0.5%
Density	0.65 t/m ³

The handling of wood-based pellets requires attention but the advantages in comparison with the other solid biomass-based fuels, such as wood chips are the relatively easy handling, lower

transportation costs and their storability (Sikkema et al., 2009; AEBIOM - European Biomass Association, 2008).

In addition should also be noted that pellets have a low environmental impact both in the production process and usage and during the transportation: pellets contain much lower amounts of sulphur, in case of spillage the environmental damage is zero and the modern combustion equipment produce only minimal amounts of pollution to the air. Despite the pollution is minimal, it should be noted that in every process of combustion a certain amount of dust and pollution is produced. In the combustion of the wood-based pellets most of the dust produced is of inorganic salts that are mostly water soluble and therefore cause significantly lower risk to human and animal health than other types of combustion dusts. Also the CO₂ emissions are eventually recycled via the photosynthesis process. By this the combustion of the pellets is not increasing the overall CO₂ emissions in the atmosphere (AEBIOM - European Biomass Association, 2008).

The raw material is transported to the pellet plant site by truck, train or conveyor belt: especially the small and medium size pellet plants are located near to the raw material supply to minimize the transportation costs. The dry raw material arriving to the plant is stored inside silos or warehouses and later carried to the plant by a conveyor, feed screw or pneumatic appliances. If the plant has dryers the raw material can be stored also outside, for example to an area of asphalt from where it is carried by a loading shovel. In the warehouse the material is dried (if necessary) and cleaned from unwanted material, for example metal with the help of a magnet. This is especially important when using recycled wood as raw material.

After the cleansing the raw material is transported to the hammer mill for grinding where it is ground into wood flour. The raw material is ground also to make it more homogenous in size. After the grinding some 1-2% of water in form of steam is added to the flour to soften the lignin and to increase the binding of the particles. The temperature used in the pressing is approximately 70 °C and together with the moisture they give the end product a nice shape and shiny exterior. Additionally, in the pressing other natural adhesives, as starch can be used. In the pressing the raw material is pressed with a specific pelletizing machine with ring or plane type die block. The domestically used equipment for pellet production are primarily imported from Scandinavia, Germany and Austria, but also some minor Finnish equipment manufacturers exist. The domestic producers concentrate mainly on silos, storages and conveyors whereas the foreign producers

manufacture for example pressers and hammer mills. After the pelletizing the end-product is cooled down and sieved before storing. During the cool down the lignin in the wood material hardens. Now the pellets are ready to be transported to the end-user via truck, train or cargo ship (Rissanen, 2008; Hansen et al., 2007; PELLETime, 2008).

After the pelletizing process the pellets for bulk for residential heating are stored in storage facilities at either the plant or the distributor before selling the bulk to the consumer. The situation with bulk pellets for large-scale power production is more complex: the storages show also signs of seasonal and market fluctuations and this has to be noted in the logistics of the bulk pellets. The storage of the pellets can be quite large in some cases, for example in big harbors such as Rotterdam, where according to Sikkema et al. (2009) the intermediate storage was approximately 200,000 tonnes in 2007.

The small-scale pellet heating system consists of burner, boiler, feed screw or similar and storage silo. The pellets are stored in the silo near the boiler and burner room. Since the wood pellets are easy to catch fire and susceptible to moisture, the silo has to be totally dry, dustproof and non-electric. The silo should be big enough for the amount of whole years pellet consumption or a bit bigger. Estimated amount of pellet consumption per year for a small-scale house is about 4 tonnes of pellets. This equals as 6.5 m^3 (1 m^3 of pellets weights about 600-750 kg). The efficiency of a pellet boiler varies within the age and shape but a normal efficiency is about 85%. It is also good to bear in mind that the final efficiency of the heating system is made up also from good isolation, tight structure and sufficient ventilation (Bröckl et al., 2010; Motiva Oy, 2012).

The pellets are moved from the silo to the burner with a feed screw or similar device. After the transfer pellets are burned in special pellet burners in different temperatures and the piloting unit adjusts these manoeuvres (Bröckl et al., 2010). The burner can be special-made pellet burner or an old burner that has been constructed for oil or wood combustion. Usually the solution is to use separate units of burner and boiler, but the system can also consist of a combination unit where the burner and boiler are set together. These new combination solutions are easy to use, they have an automatic cleaning system and their efficiency is high. After the combustion the energy released from the pellets is transferred via boiler and water into the heating system. The heat can be transferred to the household via underfloor heating or more traditionally via radiators. The burner and the chimney have to be swept regularly to minimize the emissions and to prevent

unwanted fire. Also the silo is good to be cleaned approximately once in every three years: the fine-grained material on the bottom of the silo might harm the operations of the feed screw (Bröckl et al., 2010; Motiva Oy, 2012).

The above-described combustion processes are not the only ones for the burning of the pellets: also a specially made pellet fireplaces can be used in heating purposes. These specially engineered fireplaces are light-weight and automatic devices that are operated via thermostat or piloting unit, and should not be mixed up with the combustion baskets for normal fireplaces. The combustion process can be programmed to start and stop with a precise schedule and the ignition is handled electronically. The pellet container is much smaller in these fireplaces and normally lasts from one day use up to a week. The normal output of a pellet fireplace is approximately 2-20 kilowatts (kW), and as a special feature the fireplaces are fast to produce heat. Therefore they are optimal for small-scale usage, for example to cottages. The fireplace can also be attached simultaneously to a solar panel and by this the ecological footprint of a cottage, house or even a block of flats can be made minimal (Torkko, 2011; Walden et al., 2001).

As in all combustion processes, also in the combustion of wood-based pellets, some particles are released in the atmosphere. According to Sippula (2010) the emissions from the combustion of the wood pellets is the lowest one of all kinds of wood combustion processes. Sippula also states that the small-scale particles from the combustion are less hazardous to health in comparison with the other wood or oil combustion types. Also the fire safety is top class.

3.2 Pellet production, distribution and usage in Finland

The pellets were first introduced in Finland already in 1979 with the brand name “Woodex” as Technical Research Centre of Finland (VTT) was making experiments with the pelletizing process. During these days the prices of oil and electricity were so cheap that there still was no room for a new renewable energy source in Finland. Finally in the break of the millennium the pellet found its way back to Finland through Sweden (Tuohiniitty, 2012). The domestic production of pellets started in 1998 as the first pellet production facility was built in Vöyri by Finncampi Oy. Since then the domestic production have been rising and at the moment in January 2013 there is 29 domestic pellet plants in work and in addition there is 3 new plants either under construction or being

planned. As said earlier, sadly the pellet markets have been going also through some rough times and the domestic production has had to be adapted with a rough hand: VAPO Oy had to close three heavily un-profitable plants and in addition also two minor plants have had to close their doors. Despite the adjustments the domestic pellet markets are heavily export-oriented as 136,000 tonnes were exported in 2011, but also the domestic usage and interest towards pellets has been rising as the domestic consumption grew to 178,000 tonnes in 2011 (PELLETime, 2008; Tuohiniitty, 2013).

Generally the pellet markets are divided into three categories: small-, medium- and large-scale users. The categorization is done by the size of the boiler or stove in use. The classification in Finland also follows these categories. The small-scale users apply pellets as primary heating or in fireplaces; this group consists of private households and cottages. Normally the group of small-scale users utilize the pellets mainly in boilers under 25 kW, pellet stoves or specially designed buckets for normal fireplaces. Medium-scale usage consists of public buildings and commercial and industrial premises with a boiler size from 25 kW up to 2 mW. Large-scale users are mainly district heating plants and CHP plants with a boiler of capacity more than 2 mW. The individual consumers can be characterized also via yearly demands of the pellets. This categorization is, respectively, less than 10 tonnes, 10-1000 tonnes and more than 1000 tonnes of pellets per year (Selkimäki et al., 2010). Normally in the domestic large-scale use the pellets are often applied together with peat or coal in the Finnish heating plants. In this kind of combustion the pellets are pulverized before usage. This allows lower requirements for quality than in smaller scale usage. Excluding the heating plans, pellets are applied in larger scale use also for example in Valamo monastery in Heinävesi in Eastern Finland and in various minor airports (PELLETime, 2008; Ericsson et al., 2004).

Pellets can be delivered to the end-users or retailers in either bulk or in small and large sacks. Collecting the pellets straight from the plant is also possible for private users, but this is rarely applied in Finland. The small sacks are usually approximately 15-40kg of weight and sold via retailers. Unlike in some other countries, for example in Sweden, in Finland the market of the small pellet sacks is of minor role: the Finnish pellet manufacturers rarely have even invested in machinery for smaller packaging and approximately only 5% of the whole production is sold in small sacks. The large sacks are normally 500kg each and sold via retailers. Even this is not always fully automatized in Finland and needs extra labor (PELLETime, 2008).

Domestically the biggest share of the pellets is transported to the end-users in bulk transportation. These bulk transportations to the small and some of the medium-scale end-users are usually done with a specially designed pneumatic truck; in the private usage the material has to be first class. In the case of the large-scale users the pellets are distributed normally by using normal, large trucks; these normal trucks can be applied since the material is pulverized before the combustion. Normally a single delivery of bulk is three tonnes minimum. Since the domestic wood pellet usage is still not so advanced sometimes the pellets can be delivered also with the existing machinery used for animal feed transportation (PELLETime, 2008).

The exportation from Finland is mainly done via large cargo ships with a size of 2000-4000 tonnes. Only a minimal share of the production is exported from the Northern Finland with trucks to Sweden. The pellets are transported to the harbors with trucks or trains when possible. The pellets are normally stored in the harbors before loading into the vessels. The loading of the pellets into the cargo ships is normally done with a crane in the open air; during the loading the weather conditions have to be good enough to keep the quality of the pellets (PELLETime, 2008). For promoting the pellet usage ensuring the good quality of pellets through the whole chain from production, delivery and handling is crucial in order to sustain the ability to compete with other, mainly non-renewable energy sources. This can be guaranteed with high class raw material, but also with high class distribution systems as the pellets are vulnerable for example for shaking and trembling (Selkimäki et al., 2010).

3.3 Expected future trends in Finnish wood-based pellet production and trade

With the present acts it is estimated that the amount of bioenergy use will rise by 20% to the year 2015, and if the acts are enhanced even more, the raise could be even 50% (Rissanen, 2008). Although the bigger scale investments in the pellet technologies is rising, still at the moment the majority of pellet users are private households, but the investments in pellet systems have been modest until the last years. According to the Finnish Pellet Energy Association there is a huge potential for pellet heating as the user group could be at least five times higher than it is now. Most of the users are normally households that are transforming the old oil heating system into an

equivalent system with pellet usage. Some of the electrically heated households could also be attracted to the usage of wood pellets appealing to the high energy prices. Pellets are ought to replace in some scale the usage of firewood in fireplaces as the special-made pellet fireplaces could become general (PELLETime, 2008).

Already the large-scale usage is showing strong marks of increase, but especially the arrival of the dust combustion of the pellets will enhance the pellet markets as the production and handling of process steam in pellet combustion will become easier and more efficient. This new method will also improve the cost-effectiveness of the industrial usage of pellets. This could be seen also in the energy and pellet markets: due to the economic situation the energy producers cannot transfer the costs of energy production to the consumers until forever and are enforced to search for new solutions, such as pellets, for more profitable energy solutions. This will obviously lead into higher demand which will benefit the pellet producers (Tuohiniitty, 2012).

From the market point of view, in Finland still lays a big potential to increase the production and capacity, as well as the consumption of pellets. It can be expected that in the near future the standardization of pellets will give a boost for the small-scale consumers to convert into pellet heating system. This will widely offer the industry chances to expand (Selkimäki et al., 2010).

The main challenges in the pellet industry concern obstacles in the political and policy fields. The taxes and other policy instruments should be harmonized over the borders and the role of biomass usage in heat production should be maintained and expanded. At this moment the relative cost difference in total heating is quite modest in comparison with the fossil fuels. This combined with fairly high investment costs and no subsidies provided from the government is not encouraging the adaptation of the pellet heating system. Also generally the biomass utilization should be encouraged (Ericsson et al., 2004; Selkimäki et al., 2010).

In other countries of Europe a lot of the forest companies are concerned about wood-based biofuels stealing the raw material and by this making the prices higher. This is not the case in Finland, as the Finnish forest industries are encouraging the usage of biomass as energy resource, and in the long run they might even become big actors in the field. No real conflict is expected between the different actors within the forest sector in Finland (Hakkila, 2006). Traditionally the usage of wood fuels has been problematic because of the high values of pollutants, as tar, which

might even include a health risk. With the latest innovations in the pellet scene these problems can be set aside (Ericsson et al., 2004).

The next big market for Finnish pellet exports seem to be Germany, as the country is already converting to “green energy.” This might seem problematic because the Finnish domestic usage is rising, but also according to the estimates of the Finnish Pellet Energy Association the total production capacity in 2020 should be over 1.5 million tonnes of pellets per year. The rising interest with the long transport distances in Finland demand that this capacity is directed into the domestic markets (PELLETime, 2008; Kallio & Kallio, 2004; Kallio et al., 2009).

As the global economic crisis and the Russian wood tariffs are affecting Finland, the sawmilling industry is decreasing its production which directly relates to the raw material available for the pellet production. The lack of raw material is expected to affect the pellet prices by raising the total price of the final product. The competition of the raw materials with the particleboard and fibreboard industry sets the prices even higher. New materials are needed but the materials, both new and old, have to be non-corrosive and compatible with the users’ boilers etc.: one good solution for this problem could be the usage of bark in the pelletizing process. Because of the transportation of the pellets the raw materials as well as production should be first-class to avoid the disintegration during the transport (PELLETime, 2008).

To secure the availability of high-class raw material for pelletizing the EU needs to develop a certain forest policy that enhances the usage of forests as bioenergy. Also the policy should develop the sustainable forestry in the member states as this is the essential basics of securing the availability of the raw material. In the future the wood pellets can be utilized also in production of liquid second generation biofuels as lignocellulose feedstock (Finnish Forest Industries, 2012). In the future also the trade flows will expand even further and it can be expected that the industrial pellet imports will originate from Australia, South America and South Africa (Verhoest & Ryckmans, 2012).

According to AEBIOM (2008) in order to make the EU-wide conditions better for a sustained market growth some heavy adjustments have to be done in the whole union. The awareness has to be lifted up among consumers and masses, the amount of public incentives has to be higher and the quality of the services has to be managed as a unit in the whole EU area, the different pellet programmes have to be monitored more efficiently, the supply and distribution systems

have to be harmonized and to be more reliable and stable and the consumer confidence has to be lifted higher. All of these targets can be achieved via better legislative support, but also different political agreements are in a major role in establishing new grounds for the bioenergy cluster (AEBIOM - European Biomass Association, 2008).

Despite the current problems concerning the wood pellet industries in the EU region, AEBIOM also sees solutions for the problems, which can be concluded as regional and national level action plans, regulations and directives, but also enhancing the professional education programmes, visible pellet energy projects and financial incentives made especially in the countries with high biomass potential. As an example of the visibility and professional education a Finnish project named Forest Energy 2020 can be named, which is a joint research and innovation project of METLA and VTT in order to research during the years 2012-2016 the whole span of forest energy (AEBIOM - European Biomass Association, 2008; ForestEnergy2020, 2012).

4. Theoretical background

4.1 SWOT analysis

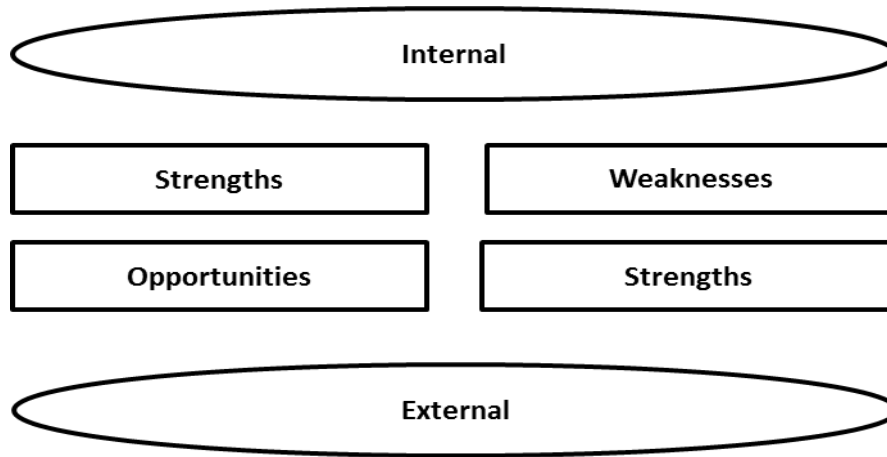


Figure 4: The SWOT analysis

“The competition is extremely dynamic. It is not characterized by balance, but by continuous adjustment” – Joseph Schumpeter, (1942)

Many of the earlier literature discussing the bioenergy and the pellet sector take a look at the industry with a certain evaluation of the overall strengths, weaknesses, opportunities and threats (SWOT analysis.) In this study the external aspects will be mainly considered from the third-party literature point-of-view and the internal aspects will be revised through a mixture of third-party literature and interviews made for the study.

A SWOT analysis is a certain, popular planning tool, originated in the 1960's, used especially in the process of strategic planning to create understanding for the strengths, weaknesses, opportunities and threats concerning the business field or a project, i.e. the goal of the analysis itself is to identify the strengths and weaknesses that lay within an organization and the opportunities and threats that are found from the environment that the organization acts. This helps the company itself to assess its position in the market. When executing a SWOT analysis it is crucial to specify already in the beginning the objectives and to identify the internal and external factors that are supportive or unfavorable in the process of execution and achieving the precise objective. It should be noted that the external parts of the analysis reflect mostly the market attractiveness. A

SWOT analysis is often used as a part of a strategic planning process. The final outcome of the analysis is often presented graphically in a matrix or a grid. Sometimes also a different variation of the SWOT analysis, the TOWS matrix is utilized: in this matrix the factors are also identified but paired with the idea of stimulating a new strategic initiative. The analysis can be also used as a part of other tools for analyzing the business portfolio (RapidBI, 2012; Dyson, 2002; Juslin & Hansen, 2006).

Normally in the strategic development of an organization the success arises eventually from the well-structured analysis of the internal and external factors: the SWOT analysis is often suggested as a good method for finding the strategic fit between the environment desires and the organizations offerings. The SWOT analysis can be also used vice versa: what the organization essentially needs and what the acting environment can offer for the organization (West et al., 2006).

After having analyzed the factors mentioned above, strategies are developed which may base on leveling up the strengths, eliminating the weaknesses, taking advantage of the opportunities or defending against the threats. The strengths and weaknesses are valued by an internal analysis, whereas the opportunities and threats are analyzed externally. The internal assessment analyzes for example personnel, facilities, location, products and services, as for the external examination takes a look at the political, economic, social, technological and competitive environment. The aim of the SWOT analysis is to reveal the competitive advantages that lie within the company or organization under review, analyze the prospects for sales, profitability and development, prepare the unit of observe for problems and also to allow the development of contingency plans. Essentially the size of the organization does not matter: the SWOT analysis can be seen as an efficient tool for all types of companies, from small and entrepreneurial workshops to the large organizations. The analysis is meant to give future directions, aid planning and produce realistic strategic recommendations for the company. The SWOT analysis also combines the elements from the normal internal analysis with the key issues from the external analysis: the objective is to see what the current strategy and the strengths and weaknesses are relevant to and capable of doing, and how the changes in the business environment could be adapted to this current situation (Dyson, 2002; West et al., 2006).

During the last decades the SWOT analysis has faced also some criticism: it has been accused of being outdated and replaced by resource-based planning and competency-based planning. It has also been argued to have too many limitations in practical use. One of the major defects of the model is that when managers have conducted the whole analysis they often fail to achieve the terms that the strategic outcomes demand. Essentially it can be concluded that many of the defects of the model itself arise from the misuse of the model: often the managers simply list the strengths, weaknesses, opportunities and threats without paying real attention to their significance. Also the reviews of a company should be done on a regular basis in order to have the full potential of the SWOT analysis. This way the implications and changes in the market environment can be fully utilized in considering the future directions of the company's strategic decisions (Dyson, 2002; West et al., 2006).

Despite the criticism SWOT analysis can be seen as the source of these more contemporary approaches. The strength of the SWOT lies in its ability to connect the internal and the external factors to stimulate new ideas and eventually strategies but also in its flexibility. The SWOT analysis should not be seen as an outdated or old fashioned technique but as a firm and basic ground ruling examination that can be considered as a foundation for resource and competency-based planning. Also the matrix should be seen as an effective tool for generating different and unpredictable series of strategic alternatives for the corporations' decision makers. Nevertheless the analysis is only as good as the original data used in the process: it has to be considered thoroughly what information will be used in the SWOT analysis (Dyson, 2002; West et al., 2006).

4.2 Porter's model of competitive advantage

In analyzing the external structures affecting the Finnish wood-based pellet trade and production Porter's diamond model (Porter, 1991) is implemented.

The theoretical framework is based on Michael E. Porter's (1991) model of "Basics of competitive advantage." The model has been first published in Porter's book "The Competitive Advantage of Nations." In this study it is used for the guidance of the research and according to the purpose of the study. The success factors presented later are originally recognized from the acts of different

nations in enhancing the prosperity of the companies, but in this study they are adapted to concern the pellet sector and business field more widely. Also should be noted that competitive advantage should be analyzed by fields of operations: the competitive advantage within a country or industry can be found in certain clusters that are joint together via vertical and horizontal linkages.

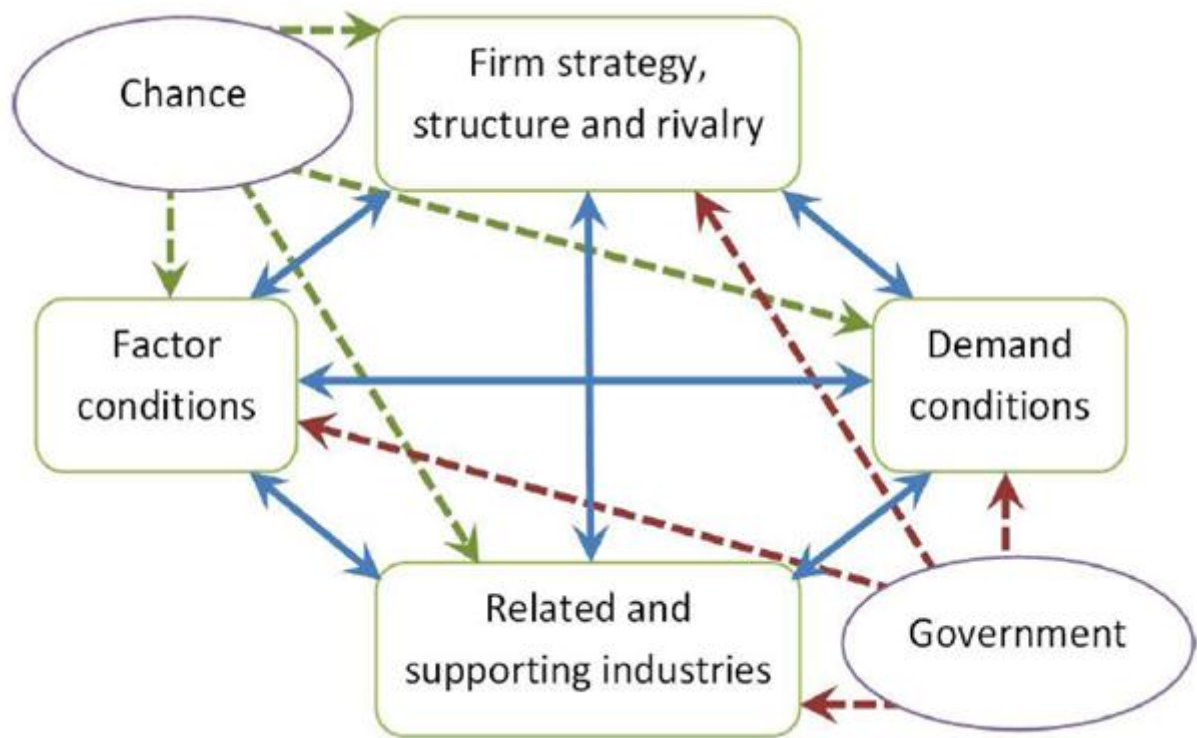


Figure 5: Basics of competitive advantage (Porter, 2009)

In the model, as shown in the Figure 5, Porter has divided the success factors into four main categories: factor conditions, demand conditions, related and supporting industries, and finally firm strategy, structure and rivalry. Also chance and government play an important role when considering the success factors. These factors define the surroundings where the companies are born and compete. They define if competitive advantage can be found in the environment. These factors also affect the different interest groups' goals and investments. The home environment of a company has to be dynamic, challenging and inspiring for the precise and wanted companies in order to find new solutions and eventually new competitive advantage (Porter, 2006).

Factor conditions

Every nation has different factors of production that the companies within the country can take advantage of. The factors can be categorized in multiple ways and these consist of different kinds of contributions that are needed in competing in the business field, such as labor, natural resources or land for cultivation. Despite the multiple categories the factors of production can be divided into two main groups: the basic and the advanced factors of production. The basic factors are for example labor and natural resources, whereas the more advanced factors can be highly trained workers. When considering the competitive advantage the advanced factors are the most crucial: if a company wants to achieve higher class advantages, such as patented production techniques the basic factors are no use. Of course also the basics, such as cultivation land is needed in agriculture and forestry. But as said, differentiated products are hard to come up with without research centers and highly skilled researchers and engineers (Porter, 2006).

Also the level of specialization highly affects the competitive advantage as the more specialized factors are more precisely directed into different fields. The specialized factors are often needed to generate advanced forms of competitive advantage that are more difficult for the competitors to adapt to. It should also be noted that the bar for the competitive advantage is constantly rising: the highly specialized and skilled factors of production of our days will be basic factors in the future (Porter, 2006).

The factors that are the most crucial for the industry do not come as heritage but they are produced in different processes. This makes the establishment and differentiation of the factors more important than their reserves. If the factors of production are used as the main tool for the competitive advantage the most important criteria is how efficiently the factors are used; how to use the factors of production, where and with which techniques (Porter, 2006). Concerning the wood-based pellets for example the different raw material solutions or the domestic origin of the final product can be seen as factor conditions.

Demand conditions

The other key element for competitive advantage is the domestic demand conditions which shapes the size, character, direction and speed of the enhancements and innovations within an industry. Concerning the demand conditions, three essential matters have to be considered: the consistency and the scale of the demand and the mechanisms and techniques how the domestic preferences can be converted into export. In all actions should be noted that the quality of the demand is more important for the competitive advantage than the quantity (Porter, 2006).

The consistency of the demand effects is on how the companies notice the needs of the customers, how they interpret these signals and how they react to them. The companies that notice the signals sooner than the others get the leader position and gain the most competitive advantage. The customers can also pressurize the companies to innovate and gain wider advantages. Essentially the demand conditions vary with the sophistication and needs of the local customers: this can be due to for example strict quality, consumer protection laws or safety measures and knowledge of the environmental standards (Porter, 2006; Porter, 2009). Concerning the pellet business the demand conditions can be defined to be the different customer groups from the private households to enterprises and CHPs.

As we know, the globalization is booming and one might think that this could diminish the role of local demand, but in fact this is not so: the domestic markets play an important role in the company's capability to see and interpret the needs of the customers. First of all it is natural to maintain focus on the markets that are the nearest ones. The demands from the domestic customers are normally seen as the most essential to maintain the pride in the own culture (Porter, 2006).

Despite this, the importance of the domestic market is even wider: the companies can interpret the silent messages in their own domestic market area and feel more confident about their own strategy. The understanding of the needs requires access and open communication with the customer. Obviously this is much easier in the domestic markets where the company already has a strong foothold. The problems normally become larger when the distance between the headquarters and the customer grows (Porter, 2006; Porter, 2009)

Considering the domestic market and competitive advantage three main compositions of the domestic demand can be characterized: segmented structure of the demand, sophisticated customers and predicted needs of the customers. The companies can gain competitive advantage by using for example the scale advantages in the segmented markets or prioritizing certain segments. When considering the different segments, the companies also have to consider the character of the customers, and only the most sophisticated and aware consumers can provide the company with competitive advantage. Furthermore, if the customers are aware, the companies should also try to predict the future needs of the domestic consumers. These predicts often generalize the upcoming needs of the abroad also. This generates a cycle where domestic demand signals the predicted needs and the companies can concentrate on certain segments with the most aware and conscious customers (Porter, 2006).

By the means mentioned above the companies can utilize the knowledge gained in domestic markets also for the market areas abroad but the domestic markets can have significant benefits for the companies also by other means. The companies can gain competitive advantage in sectors that have scale or learning advantages because these encourage the companies to invest in bigger mills and in research and development. Despite this, it should be noted that big domestic market demand is not a benefit, unless the gained benefits can be transferred also to abroad. The size of the home market is a benefit if it encourages the companies for dynamism. The domestic market should also have a lot of independent customers to create a healthy and wide environment for innovations. The investment speed is also affected vastly by the growth rate of the markets; if the rate is high, the companies are encouraged to adapt new techniques and bigger mills more rapidly. The aware customers can give signals of early boredom towards the products or services of the companies; this should lead to a continuum in the field of innovations. With a higher rate, new adaptations and signals from the aware customers, the companies can gain ground from the future markets also abroad by having the “early-bird” advantage (Porter, 2006).

The domestic demand conditions can affect also in a third way: the domestic demand might become international whereupon domestic products and services are pushed abroad. This can happen via local customers that are both mobile and travelling or belong to an international organization. These groups can easily bring coverage in export markets. The travelling consumers prefer to use familiar products also abroad: the communication is easier, there are fewer risks and

the operations are more effective. The desire to use the players from the domestic market often makes the companies to expand abroad (Porter, 2006).

The domestic demand can also transfer the desires from the motherland to abroad and enhance the demand. This might happen for example when students study abroad and finally return to their homelands bringing the preferences from the other country with them. The domestic demand and preferences can be transferred abroad also via cultural exports, such as TV, movies and tourism (Porter, 2006).

Related and supporting industries

The domestic market cannot respond to the aware and conscious customers without the third key element of the competitive advantage. This means the internationally competitive related and supporting industries. The competitive advantage of one supplier can benefit many different producers because the suppliers produce inputs that can be used in various segments for production, innovations and internationalization (Porter, 2006). Related and supporting industries for the wood-based pellet industries are connected to the other companies in the forest industry; the raw material comes as a by-product from other facilities either in Finland or abroad, for example Russia. Also the machinery of the pellet industries comes from other actors of the business.

Internationally competent related industries can benefit multiple areas in multiple ways. First of all, the players that are closer to the end-customer can gain rapid, easy and efficient access to the cheapest inputs. The suppliers also offer benefits by continuously coordinating the domestic markets. The bindings are easier to create if the supplier is close: normally the biggest benefits concern the innovations and upgrades. The world class suppliers added up with close bindings to the field of operations equals as competitive advantage as the suppliers help the companies to understand and benefit from the latest procedures and techniques. The companies also gain rapidly information about the new innovations but they can also affect the research and development processes of the suppliers. This kind of problem solving leads into faster and more efficient solutions. Often the suppliers also have significance in spreading the new innovations in the domestic market; this benefits the whole domestic industry. The benefit of the domestic

market is also usually a matter of honor for the suppliers; this, added up with backward information of the market area is why foreign suppliers normally cannot compete with suppliers from the motherland. It should also be noted if a country has competent supporting industries, this often leads into different kinds of new and competent, competitive industries as the similarity of the culture make the interaction easier (Porter, 2006).

Firm strategy, structure and rivalry

The fourth key element for competitive advantage is the character of the domestic competition and the environment where the companies are founded, organized and led. The goals, the strategies and the ways of organizing vary widely, and the benefit for competition is determined by how well these choices and the sources of competitive advantage are mixed together. Also the character of the domestic competition shapes the innovation processes and the possibilities of the international success (Porter, 2006).

The situation in different countries shapes the processes how different companies are led and the way they compete. The companies normally gain ground in segments that are led and organized in a way that fits together with other key factors of the competitive advantage. The differences between the cultures of leading and organizing in different countries and companies can be explained with the differences in education systems, orientation, emphasizing the group work or hierarchy, attitude towards personnel entrepreneurship, internationalization and new languages etc. Also the political differences within the nations can have significant influence on the internationalization. These differences result in both benefits and disadvantages: the relationship between the directors and the employee is crucial for the way the company innovates (Porter, 2006).

Between companies, significant differences can be found in goals and motivation. The companies normally succeed in fields of business where the goals and incentives are in harmony with the sources of competitive advantage. Also in many sectors the segments that succeed have the most continuous investments; i.e. the companies are successful in fields of operations where they put the most effort in (Porter, 2006). The wood pellet segment could think for example how the end-customers could be served better.

The biggest influences on the goals of the companies are the owner structure, the incentives from the owners and creditors, the method of administration and the incentive processes from the top brass. In addition, in every company also the individuals, the directors and the employee, have their own goals: the incentives can have either good or bad influence, and the essential question is if the individuals are motivated enough to develop their skills and work in order to enhance the competitive advantage. Often the personnel who are the most motivated and talented are drifted to the most valued companies. These employees are also normally the most committed to the organizations and bring the most value-added and competitive advantage to the company. The different incentives can be such as a bonus or promotion system, but also the taxation system within the country has a major effect (Porter, 2006).

One big driver behind the eventual competitive advantage is the competition within a country. Fact is that companies that are successful within global competition are encouraged and even forced to do continuous innovations because of the harsh and competitive environment in the domestic markets. The local firms force each other to lower the costs, improve the quality and service but also to innovate new products and processes: the companies are both afraid to lag behind and encouraged to move forward. In this race the companies are also forced to seek for higher levels of competitive advantage: trademarks, copyrights, new global marketing networks etc. Without the domestic competition the companies would settle for the normal factors of production and would even use them more inefficiently. Often this race helps the whole industry as the companies copy each other. This diffusion of information and knowledge is more rapid in areas that have more companies of different industry (e.g. Silicon Valley, Madison Avenue and Wall Street). In these areas the industries are dynamic and maintain their competitive advantage. The dynamism within an industry also prevents the government to intervene with unhealthy supports etc. (Porter, 2006).

The domestic competition often moves to a whole new level – to consider even personal life and emotions. Despite this, the hard competition promotes the competitive advantage and pushes the companies to export in order to ensure the growth. If no good competition exists in the domestic market, the corporations settle for only the market area of the homeland (Porter, 2006).

The innovation process within the domestic market can be also encouraged with new entrepreneurs: the new companies try new segments and new approaches. These new firms can

born in two ways: as new “branches” from the old company as the employees are unsatisfied or have better ideas and decide to establish a company of their own or by the old companies moving into new industries (Porter, 2006).

The importance of chance and government for competitive advantage

The competition environment is shaped by the four key elements of the competitive advantage but also the chance and national governments have an essential role in this cycle. Concerning the wood pellet industry, most essentially the role of government can be seen as taxing decisions or subsidies which can significantly alter the situation of the whole industry.

In most of the successful industries a part of the success is actually a matter of chance where the differences between nations and companies have no role and these matters cannot be reached. These coincidental events may contain inventions, long lasting irregularities (such as oil crisis or biotechnologies), significant alterations in rates of exchange, and global alterations in supply and demand, political decisions made by foreign governments, or even war and other conflicts. These events are necessary in making the alterations in the competition possible: these can easily invalidate or diminish the advantage of the old players and make room for new entrepreneurs and ideas (Porter, 2006).

Also the authorities and governmental power have significance especially in international competitive advantage. The national government can have either positive or negative effects in all four key elements of the model: the effective elements can be such as subsidies or regulation of the capital markets. The needs of the customers can be affected by regulations and norms. The government and other political actors can easily affect also the pellet industries by different taxing procedures, subsidies (or with the lack of them) or just by adding the general information level of the whole industry. Also in many cases government plays an active role also as a customer (Porter, 2006).

4.3 The marketing approach – Quality as a part of the competitive advantage

Competitive advantage can be perceived also through quality. In order to do so, the quality requirements of the customer have to be known precisely and this operation requires an instrument for measuring.

The concept of quality is not easy to define. Normally the researchers and customers see quality in a different way: the definition is extremely hard concerning the service-quality. Unlike with products or goods the service-quality is intangible and difficult to measure; no such indicators as durability or number of defects exist (Parasuraman et al., 1988; Garvin, 1984).

Garvin (1984) defines quality via five different approaches: (1) the transcendent approach of philosophy, (2) the product based approach of economics, (3) the user-based approach of economics, marketing and operations management, (4) the manufacturing-based and (5) value-based approaches of operations management.

The transcendent approach of philosophy

Quality can be seen synonymous with “innate excellence.” This way quality is absolute and universally recognizable to all, a mark of high standards. The proponents of this view claim that quality cannot be universally defined but the definition comes only through experience. In this view, quality can be seen highly platonic (same way as e.g. beauty), i.e. although quality cannot be measured one still knows what it is (Garvin, 1984).

The product-based approach

Quality is precise and variable, differences in quality is due to the differences in quantities of ingredients or attributes possessed by a product. For example in the pellet industries the pellets are of good quality because of fine sawdust that does not contain impurities. Differences in the

quality and ingredients result as difference in the quality. This also means that a company can enhance the quality of its products via higher costs (Garvin, 1984).

The user-based approach

Different individuals are supposed to have different values and needs, and they also interpret the quality differently. Those goods and products that satisfy the individuals' needs the most are also regarded to have the highest value and quality. This means obviously that in this view-point quality is something highly personal and subjective. This view has led to "ideal points" in the marketing literature: precise combinations of product attributes that provide the greatest satisfaction to a specified consumer. The concept also face some problems: how to aggregate varying individual preferences in order to lead them into a meaningful definition of quality at the market level and how to distinguish those product attributes that connote quality from those that simply maximize customer satisfaction (Garvin, 1984).

The manufacturing-based approach

In contrast to the user-based viewpoint where the quality is based on consumer preferences and the determinants of demand, the manufacturing-based approach is mainly rooted in engineering and manufacturing practice, and the term of quality is defined as "conformance to requirements." The excellence in quality is normally equated with meeting different specifications and making things the right way already in the beginning. The properly made and constructed items, goods and products are the ones that offer the most quality. In this approach the improvements in quality, reduced number of deviations, leads eventually to lower costs because preventing defects is more profitable than repairing or reworking them (Garvin, 1984).

The value-based approach

This point of view defines quality by the terms of costs and prices: a product that delivers performance at a good price or conformance at an acceptable cost is also the product of the best quality. This equals that a product with excellent quality added with an overly high price cannot be of the best quality (Garvin, 1984).

The different conflicts between for example marketing and manufacturing departments can be explained by using these five approaches to quality: marketing people normally see quality as user-based or product-based. Higher quality equals to better performance and other cost-increasing improvements. The thing that matters the most happens in the field, not in the factory. On the contrary manufacturing people take a different approach: the emphasis is on doing the right things already at the first time: poor quality is associated with huge amounts of rework and scrap, and the improvements in quality are expected to result as lower costs. With the different approaches to quality these conflicts can be made easier and make the communications work. The approach should always be shifted as the goods move from design to market: first through user-based market research, then translated into identifiable product attributes of a product-based approach. Next step is to organize the manufacturing process to ensure the products specifications with a manufacturing based approach. If any of these approaches is ignored the product will not meet the standards of a quality product (Garvin, 1984).

In addition to the different approaches Garvin also defines eight different dimensions of the product quality: performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality. The different definitions of the dimensions combine elements from the different approach angles (Garvin, 1984).

These dimensions are highly valuable in competing with quality: a company does not have to go for all of the eight dimensions at once, but they can concentrate on segmentation with special attentions. After the managerial operation of selecting the dimensions that the company wishes to compete, the company has to tailor also its organization and operations to meet these specified standards. The reason why organizations are so enthusiastic about quality is that good quality correlates positively with so many different variables, such as price, cost, advertising and market share (Garvin, 1984).

Quality has been also determined also through many other ways, but according to Weinfurter & Hansen (1998) many of these definitions do not involve the insight of a customer, one essential aspect of the whole marketing process: finally the customers define if the product is of good quality or not. The customer wants the product or service to fulfill the task that is specified for it. If this does not happen, the customer obviously cannot say that the product or service is of good quality (Ennew et al., 1993; Weinfurter & Hansen, 1999).

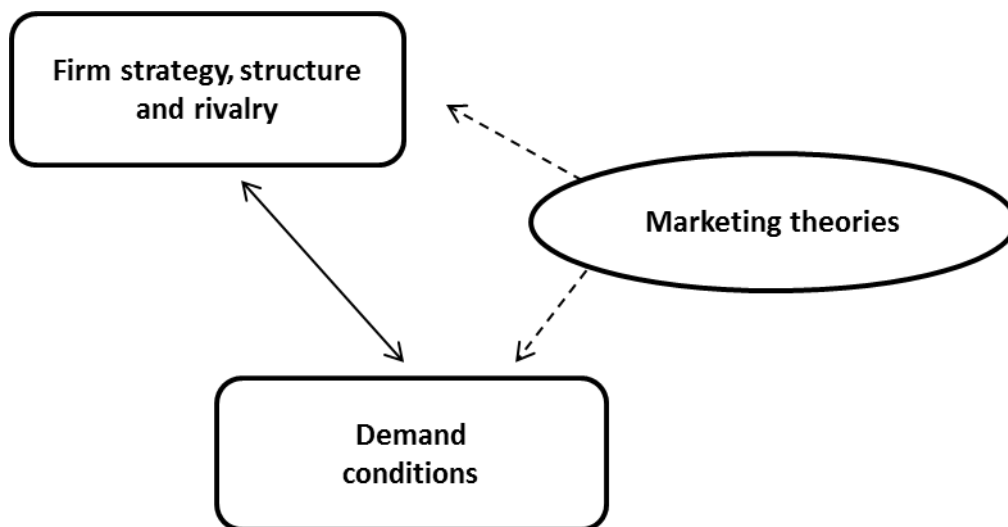


Figure 6: Connection between the Porter's model and the marketing theories

The marketing in general, through different theories, can be seen as a force especially affecting the demand conditions and the firm strategy, structure and rivalry of the Porter's model of the basics of competitive advantage. Also the questionnaire sent to the retailers of the pellets will focus to especially these aspects and the phenomena related to the marketing in general.

5. Data and methods

5.1 Data of the study

Both primary and secondary data is used in this study. The secondary data used in this study was gathered mainly from literature and Internet sources. It consists of different kinds of research reports and papers, books, dissertations, magazines and web pages. Some of the background data were based on older data sources, but generally the secondary data used was as up-to-date as possible due to the heavy fluctuations of the whole economy and the bioenergy industry in Finland, and in the whole EU at the moment. The secondary data was used in the literature review, but it was also taken advantage of when gathering the results for the SWOT analysis and also in the design and the implementation of the survey form.

The primary data of the study was gathered from the Finnish retailers and manufacturers of the wood-based pellets. All of the producers were also retailers of the pellets. The survey sample was hand-picked from the Internet sources of a large field: among the respondents are alike small, medium and large retailers varying from local producers who only sell wood-based pellets to a small region, to nation-wide and even Europe-wide retailer chains and bigger producers who sell to the retailer chains, but also directly to the consumers. Geographically the population of the survey was located in all different areas of Finland excluding the whole area of Lapland and the Åland Islands. These areas include only minor retailers and producers of the wood-based pellets and therefore were drawn off from the survey.

In the data gathering a specific questionnaire was designed and the survey was conducted by the author. This questionnaire was formulated according to the theoretical framework of the study. The survey was conducted during summer and early autumn of 2013 and the questionnaire was directed to a sample of various employees mainly from sales force and managers of the different companies. The idea of the sample was to get an extensive result with viewpoints from various levels of the organizations. The sample was hand-picked from the online databases of the domestic wood pellet retailers and producers.

The survey was conducted in a self-administrated form via Internet. The idea was to focus on the sales personnel who are daily and directly involved with the customers and the pellet retailing. The purpose of the questionnaire was to find out the views of the managers and the sales force

about the opportunities, main challenges and especially the customer's opinions about the current state of the wood pellet retailer industry and the positive or negative factors that are affecting the whole pellet scene in Finland. Also the survey tried to get a wide perspective of the targets for development in the future and by this to help the whole industry gain more ground in the domestic market (for the precise survey questions, see Appendix 2).

As the study was first of its kind in Finland the focus group identification turned out to be a hard task: the first idea was to examine the pellet consumers, but in a wider perspective this idea turned out to be difficult to execute as no detailed lists of pellet consumers exists. Therefore a population of 877 independent manufacturers and retailers or bigger retailer chains and their managers and sales force, or equivalent personnel from the sections in charge of the wood-based pellet commerce was identified as the focus group of the study. Later a total of five companies were ruled out from the sample due to no obtainable information of contact. After this procedure, the final sample now consisted of 872 contact informations. The pre-criteria were that the personnel whom will receive the questionnaire are responsible of the pellet sales.

The recipients of the questionnaire and their information were mainly found from the Internet and the web pages of the pellet retailers and producers. Eventually the population was hand-picked from the list of employees; in this process all of the people who are not dealing with the pellets in their daily routines were outlined. After defining the criteria for the population and check-up of their job description, the survey itself was first sent to 226 recipients in June 2013. From this population only five of the respondents answered to the questionnaire. In August 2013 a reminder of the questionnaire was sent to the same population of recipients, this time a total of two persons answered. By this point it was obvious that something had to be done differently in order to collect the sample. Later, after the Finnish summer holiday period in August 2013, the population was extended to cover more of the bigger retailers and retailer chains. This time a total of 656 new recipients were added to the contact list; in total the full list of recipients climbed up to 872 persons.

In early August the questionnaire was sent to the new 656 recipients. Before the reminder round was sent in late August a total of 18 recipients responded to the questionnaire. The reminder was sent in early September, this time 12 responses was gotten from the recipients.

In late September 2013 the data gathering was considered to be finished with altogether a total of 39 replies to the questionnaire.

Although the sample of the survey was big and carefully hand-picked, the number of final entries did not match the potential. Even after the e-mail reminders the response rate for the survey remained at surprisingly low 4.5%. The author tried also to motivate some of the participants via phone contacts, but as the sample was large and many of the recipients could not be reached this way, the approach was decided to be done only via e-mail. In order to get more responses to the questionnaire, the respondents were promised to get a free copy of the final results via e-mail after the work has been conducted and finalized.

The initial aim was to reach personnel and sales force from as many levels as possible of the companies under examination. Although the response rate for the survey remained notably low, it can be said that the initial aim was accomplished: from the overall 39 respondents six described themselves as directors, six store managers, five heads of departments, two foremen, 14 salespersons and six as independent entrepreneurs. By these different levels of hierarchy a precise review of the customer experience could be done. The review is even more efficient when considering the vast geographical outline of the survey: the whole Finland, excluding Lapland and Åland Islands, was covered. The dispersal of the responses (see Table 4) creates an accurate sample that reflects the whole country in this case.

Table 4: The survey responses according to the location of the business units

Region	Number of responses
Capital Region	4
Southern Finland	10
Eastern Finland	7
Western Finland	15
Oulu Region	3
Total	39

Most of Finland's economic welfare is located in the southern parts and the pellet industries are mostly located in the more rural parts of the country. Also many of the pellet retailers are chains of stores or independent stores that sell also various implements for agriculture and forestry. This acts as an explanatory factor for the large amount of responses from the western parts of Finland as many of the stores are located in this more agrarian part of the country where the demand is also higher.

5.2 Methods of the study

5.2.1 Literature review

According to Harris Cooper (1998) literature reviews normally appear as independent works or more often as brief introductions to new primary data. If the target is to introduce new primary data as in the case of this study the scope of the literature review is fairly narrow, yet often the depth and breadth of the literature review define the credibility of the study. It is restricted to the theoretical works of the specific issue of the new study. It is a selection of different documents available for the topic in order to fulfill certain aims or express certain views on the nature of the topic and how this particular topic is going to be researched and to show a concise link between the new study and the older secondary data. The aim is simply to provide a solid foundation and support for the new study in process.

It is also crucial to familiarize oneself with the topic under the scope; this was very important also in this study as the literature review was especially useful to generate a deep and thorough theoretical background to assure the knowledge of the later empirical study results (Juslin & Lindström, 1998).

5.2.2 Design of the survey and the questionnaire

The design of the questionnaire was done according to the theoretical framework of this study: the main objective was to research what are the most important factors, advantages and disadvantages for the domestic consume of the wood-based pellets. While the key objective was to find the main positive and negative factors affecting the purchase and the usage of the pellets, the questionnaire also concentrated on finding approximated future trends to be applied in the whole domestic pellet industries.

As said earlier, the survey itself was conducted online utilizing a specific survey application provided by the University of Helsinki (<https://elomake.helsinki.fi>). The questions were categorized in four different segments:

1. The general background of the respondents company (questions 1-5)
2. The basic information concerning the company's wood pellet sales (questions 6-11)
3. The current state of the wood pellet trade (questions 12-15)
4. The estimated future trends of the wood pellet trade (questions 16-21)

In the first block of questions the respondents were asked to describe the background and their own status in the company. In the second block the respondents had to give specifications and key figures concerning the pellet sales. In these two first parts the questions were mainly open; the respondents were able to fill in the information without restrictions.

In the third and fourth part the respondents were asked to analyze the present state of the wood-based pellet business from the viewpoint of their own company and the future, upcoming trends in the whole wood-based pellet industries. In the third question block the respondents were given the chance to rate their opinions on a scale which consisted of five alternatives from “not

important at all” to “very important.” Three of the questions in this part also had the option of “I cannot say.”

In the questions 17-18 the respondents were given three choices: “decreases,” “will remain about the same” and “increases.” The last questions from 19 to 22 were open fielded (for the survey form, see Appendix 2).

Each of the 872 recipients was sent the questionnaire via e-mail with a covering letter (see Appendix 1 for the cover letter). The covering letter presented the general background and aims for the study, to what it is related to and who is conducting the study and under which supervision. The covering letter also mentioned that the survey answers will be analyzed confidentially and anonymously.

Although the response rate was modest, the respondents were motivated and wrote good answers also to the open fielded questions with good comments. The respondents were mostly of higher level decision-makers, therefore it can be said that a demonstrative sample of the industry perceptions was created with the survey.

5.2.3 Data analysis

Already in the early phases of the research the SWOT analysis was chosen to be as one of the frameworks of inspection because its applicability in analyzing the domestic wood pellet industry. By analyzing the strengths, weaknesses, opportunities and threats the author was provided with a thorough overview of the current state of the Finnish pellet cluster. The results of the secondary data and the analysis made the grounds also for the questionnaire design. In the design of the survey form the Porter’s and Garvin’s models were also taken advantage of.

Due to the relatively small sample gathered, the Kruskal-Wallis-test was chosen to be utilized in the analyzing of the sample. The survey results were analyzed based on the data coded on classification scale, which made it statistically unorthodox to utilize other tests. The Kruskal-Wallis is also optimal for the testing based on more than one grouping variable, which was essential in this case (Karjaluoto, 2007). The testing itself was conducted utilizing the IBM SPSS Statistics-

program (more commonly referred to as SPSS). The test was conducted for the sample of 39 responses.

In the analysis phase of this study the p-value for statistical significance was set to be $p = .10$ due to the relatively small data of the study. Despite the study uses a different p-value, in general it can be said, according to Mellin (2000), that if the p-value would be under .05 (in this study .10), then the null hypothesis would be disqualified, and the alternative hypothesis would be claimed. The null hypothesis normally is equivalent to the results being expected (Mellin, 2000).

Three different criteria for grouping of the data for analyses were tested in order to receive statistically as significant results as possible. In the first grouping the data was divided into three different groups according to the headcount of the respondents companies. This did not give enough statistical significance: only three statistically significant results with the Kruskal-Wallis test could be perceived from the data with the current significance level $p = .10$. The respondents were very much alike in their responses.

The same happened also for the second grouping, to the grouping according to the geographical location: this model gave even less statistical significance than the first one. The data was again analyzed with the Kruskal-Wallis test; this time altogether three significant values could be found along with four suggestive values. So, again the grouping had to be changed.

As a third option for groupings in Kruskal-Wallis test a lot more statistical significance was found: the data was divided according to the annual sales volume of the pellets (tonnes/year). The three groups utilized were as follows:

- Low sales volume companies which sell 1-99 tonnes of wood-based pellets per year
- Medium sales volume companies which sell 100-999 tonnes of wood-based pellets per year
- High sales volume companies which sell over 1000 tonnes of wood-based pellets per year

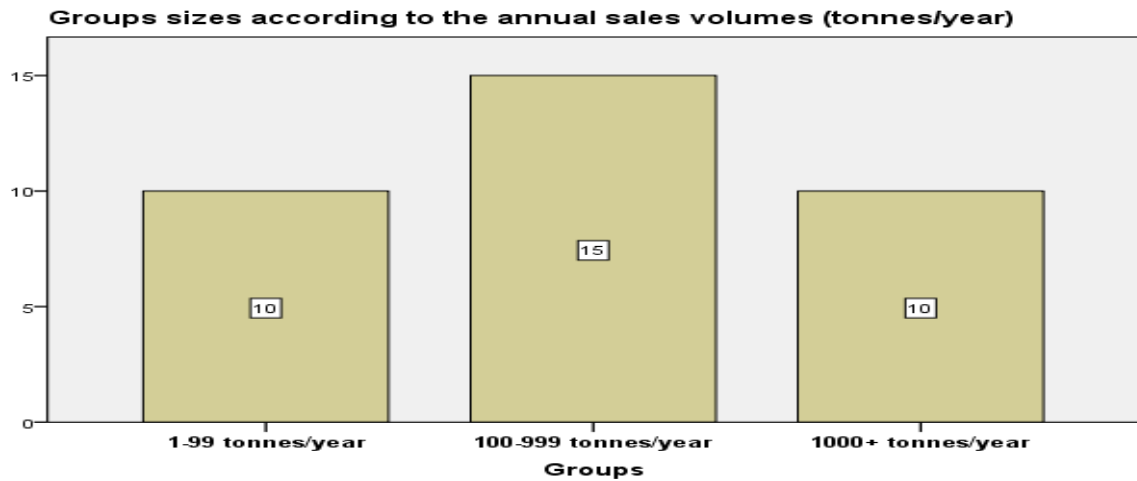


Figure 7: The different group sizes of the study according to the annual sales volumes

In the analysis of the survey it should be noted that in total four of the 39 respondents did not know their annual sales volumes in the questionnaire. These four respondents were drawn out from this analysis, and by this the total amount of respondents being analyzed was 35.

As can be seen from the Figure 7, after the final regrouping process the amounts of variables in the three different groups according to the annual sales volumes (tonnes/year) were, respectively, 10, 15 and 10.

In addition to the new groups, it should also be noted that in the analysis the option of "I cannot say" was excluded. This way the results of the analysis can be seen as more accurate, but the sum of variables in some cases may vary.

6. Results

6.1 SWOT analysis – The current state of the domestic wood pellet industry

6.1.1 Strengths

The Finnish pellet industries represent a fairly new kind of renewable wood-based bioenergy solution that consists mainly of domestic raw materials. As the wood-based pellets are made of remainders from the sawing industries, they are also environmentally friendly and a safer solution for the humankind: the trees capture CO₂ in the growth and photosynthesis process and according to Statistics Finland make the pellets almost emission-free in the calculations. This means that the carbon foot print is very low (PELLETime, 2008; Alm, 2008; UNEP, United Nations Environment Programme, 2009; Statistics Finland, 2011b).

Finland is also very rich with the wood-based raw material that can be used for pelletizing. Of all the roundwood handled, almost 40% eventually becomes as residues that are applicable for different kinds of bioenergy usages (PELLETime, 2008; Ericsson et al., 2004). The vast Finnish forests also provide a local and long term source of raw material and eventually energy (PELLETime, 2008; Alm, 2008; YLE, 2013).

Finland is still heavily export-oriented when it comes to the pellet industries. The EU and the Finnish government have set certain goals for the Finnish bioenergy usage. As the market structure slowly becomes more favorable for the pellet industries, the large base of domestic producers can make Finland self-sufficient in the usage and production of the wood-based pellets. This kind of development would also enhance the Finnish employment situation, especially in the rural areas where the employment effect would be substantial. The evolvement from export-orientation to domestic usage would also help in achieving the goals set in the Kyoto Protocol (PELLETime, 2008; Alm, 2008; Selkimäki et al., 2010; Euroopan Unioni, 2011).

The pellets are relatively quick and easy to produce and they are mainly compressed from spruce and pine cutter chips, wood chips and sawdust to a small form. In the pelletizing process the wood-based pellets are pressurized to dense and low moisture content (PELLETime, 2008). This form is easy to handle and the efficiency becomes higher, but the logistical costs become lower.

The pellets can be stored also in cold storages as there is no danger of freezing. In addition also the storage space needed is smaller and does not have to be complex (PELLETime, 2008; YLE, 2013). As the wood-based pellets are safe to handle and have a low environmental impact, in the case of spillage the environmental damage is zero. Also the combustion pollution is of minimal scale and the fire safety is excellent (PELLETime, 2008; AEBIOM - European Biomass Association, 2008; Sippula, 2010).

Some of the bioenergy produced in the world at the moment compete from the land area with the cereal or other food plant cultivation. This is not the case with the domestic wood-based pellets: the trees of the Northern coniferous forest belt are slower to grow and the different types of land area usages do not have to compete with each other. The pellets can be produced also from other raw materials than wood-based, for example peat can be used (Metsäteollisuus, 2012; UNEP, United Nations Environment Programme, 2009).

6.1.2 Weaknesses

Although the wood-based pellets are relatively easy to produce, all of the materials have to be pulverized before compressing. The raw material has to be absolutely dry and cleansed from unwanted objects (Rissanen, 2008). This means more costs and more work. This, in addition to other costs, can be limiting especially the small and medium-scale producers. The cost of investment especially in the bigger scale of usage is rather high (PELLETime, 2008; Heinimö, 2008).

At the moment the acts and subsidies from the Finnish government are still inadequate. A big potential could be found from the pellets, but the government is not encouraging the conversions to the pellet usage from other energy sources nor investing in the development work (Selkimäki et al., 2010). This, with unfavorable taxation is slowing down especially the establishment of new small-scale pellet heating systems and residential usage. Also the general awareness of wood-based pellet solutions should be enhanced by the government (AEBIOM - European Biomass Association, 2008; Alm, 2008; Selkimäki et al., 2010).

Even though they are rather easy to store, the pellets are susceptible to moisture. Therefore the silo or other storage space has to be totally dry, dustproof and should be cleansed in a cycle of two to three years. In the loading and the transportation a critical weakness is often noticed: pellets

are vulnerable and the shaking and trembling is breaking the final product if the product is not top-class. This is harmful especially for the small-scale usage where the product has to be of top-class due to more sensitive burner solutions. The quality of the wood-based pellets could be easily enhanced with a common standard for the pellet production and final product, but at the moment this kind of standard is still lacking in Finland (Selkimäki et al., 2010; PELLETime, 2008; AEBIOM - European Biomass Association, 2008; Sikkema et al., 2009). As the grade of wood fuels can vary on a wide range, the guidelines have to be set because of the significant quality differences on the market but also because the emission regulations are being tightened. By the norms the usage of same terms and definitions among the producers can be enhanced and by this expand the market for solid biofuels in Europe. Furthermore, a common standard for the pellet storage, transportation and other logistics is also lacking (Selkimäki et al., 2010; PELLETime, 2008; AEBIOM - European Biomass Association, 2008; Sikkema et al., 2009; Loibnegger, 2011).

At the moment Europe is prevailed by high raw material prices and this is also reflecting to Finland. Along with the high prices for the raw material, Finland is a country of long distances and this can be seen in the transport costs. The costs of transportation become even higher if the pelletizing factory itself is located further away from the raw material source and the raw material has to be transported (PELLETime, 2008).

6.1.3 Opportunities

The Finnish forest industry is struggling with problems at the moment and they have to come up with new and innovative solutions for the usage of wood. This, along with the tightening emission regulations makes the demand for new renewable-based energy solutions higher than ever as the new goals governed by the EU have to be achieved. More problems arise for the non-renewable energy sources as the global population growth continues: the price of these energy sources will be multiplied but also the need for energy, especially sustainable energy, will become critical in the future (AEBIOM - European Biomass Association, 2008; Alm, 2008).

Finland is rich with wood-based raw material and there are many potential sources for the raw material in the future from logging residuals collected from the forest after the fellings to utilizing the bark as pelletizing material (PELLETime, 2008). In conjunction with the research for the new

materials the pellet handling and transportation can also be enhanced in order to ensure the top-class of the final product (PELLETime, 2008; Selkimäki et al., 2010).

At the moment the Finnish pellet industries are heavily export-oriented. Instead of exporting, the domestic demand for pellets could be raised by making the wood-based pellets more interesting for larger masses and by this a fair amount of pellets could be directed to the domestic markets. This would enhance the situation of the Finnish labor especially at the more rural areas of the country and could also lead to lower prices of pellets as the transportation costs could be reduced due to economies of scale. Already the industrial use of pellets is showing marks of increase, and in the future the bigger scale usage can turn the export-import ratio upside down (Selkimäki et al., 2010; PELLETime, 2008; Helsingin Energia, 2012).

6.1.4 Threats

During the last decade the number of sawmills in Finland have been decreasing. This is due to the harsh global economic environment of this moment. If this progression continues, adequate raw materials for increment of the pellet production will be harder to find. Already the raw materials are utilized in such an efficient way that new alternatives will have to be invented. In consequence this could make substantial rises to the prices of the good quality raw materials, and this would obviously lead up to higher market prices for the wood-based pellets. In addition, also the fibreboard and particleboard production are competing from the raw material with the pellet industry (Selkimäki et al., 2010).

The whole European pellet market is mostly prevailed by surplus and therefore the market prices are too low for the producers. This, in addition with the high raw material prices makes the imports, especially the transatlantic ones, to look like a reasonable solution (VAPO Oy, 2012). The Russian wood tariffs are also affecting the Finnish and the whole European markets heavily: the expected amount of Russian timber material coming to the Finnish sawmills is not certain, this could also reduce the amount of raw material applicable for the pellet production (Selkimäki et al., 2010). The Russian market can also affect the Finnish situation in other ways: the Russian price level is more undeveloped than the Finnish level, and the raw material is cheap in Russia. If the imports of the cheaper pellets from Russia increase, this could easily affect the domestic pellet

markets, but also the pellet industry of the whole Europe (Sikkema et al., 2011; Verhoest & Ryckmans, 2012).

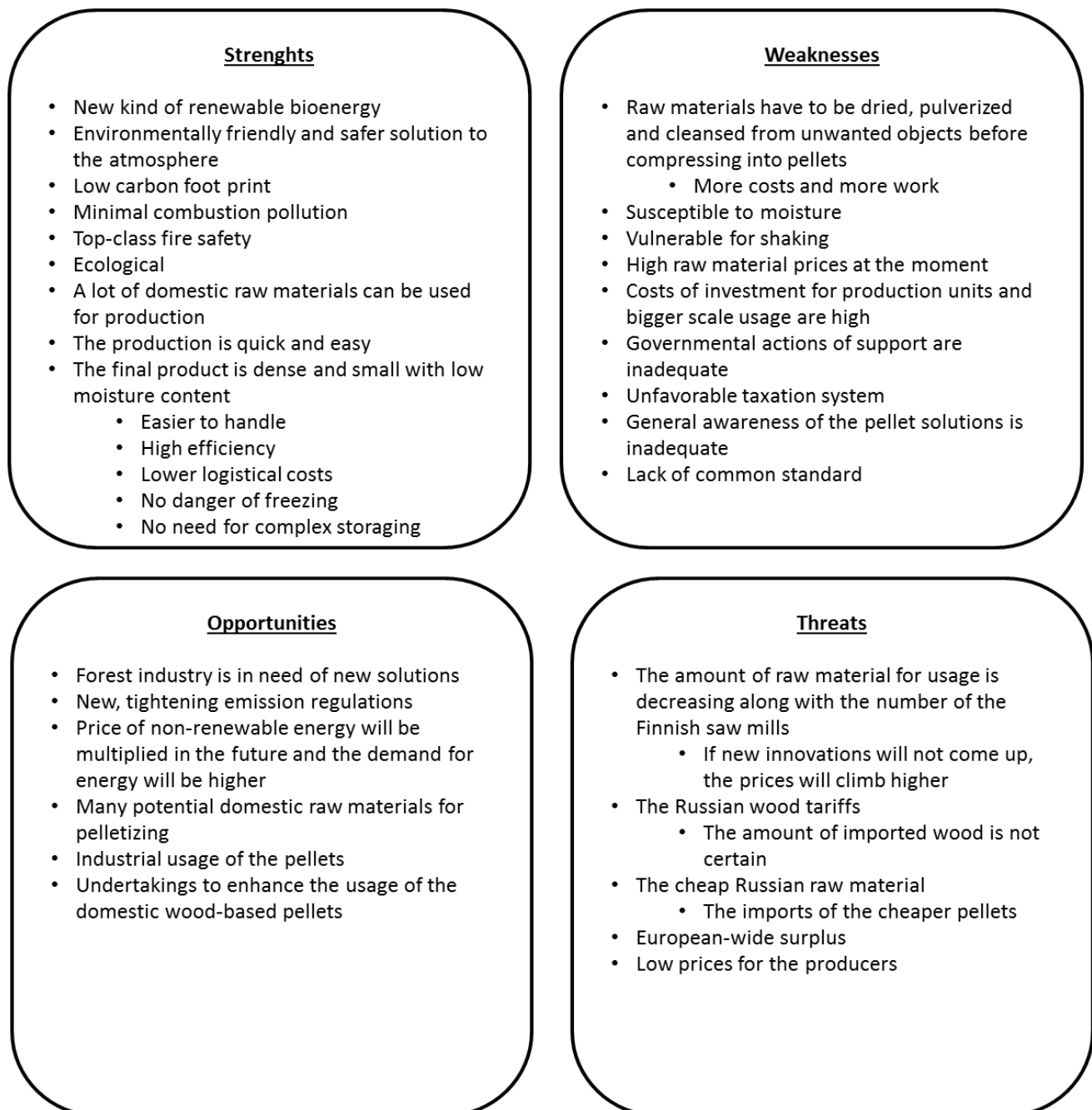


Figure 8: SWOT analysis – the current state of the domestic wood pellet industry

6.2 The survey results

Despite the fact that the Finnish pellet industries can be seen as export driven, a majority, 22 respondents claimed that they have offices or stores only in Finland, and a minority of six stated that in addition for the domestic facilities they have offices also abroad. Eleven of the respondents stated that their company has only one store or other facility. All of the respondents also said that they do pellet business in Finland, but only two stated to do business in addition also abroad. This conflict can be due to the fact that the enterprises sell other goods than pellets from their offices abroad.

Only five of the companies sold their own wood-based pellets whereas 34 of the respondents simply acted as retailers and bought their pellets from the producers. Also the retailers trust heavily upon the domestic wood pellets as a vast majority, 32 respondents, stated that 100% of their annual sales consist of Finnish pellets whereas only one of the respondents said to be fully dependent on the imported pellets. Also three respondents stated the ratio to be 50% domestic and 50% imported, one respondent 80% and 20% corresponding and one respondent 95% and 5% corresponding. One respondent did not know how much the ratio was in their company.

The companies were quite evenly dispersed when considering how the final consumers wanted to buy their pellets: all of the respondents stated to sell the pellets in multiple sizes and ways. From all of the respondents 33 claimed to sell the pellets in small sacks, 35 in large sacks and 26 as bulk. Additionally five of the respondents defined their deliveries to be done mainly as loose bulk deliveries utilizing a special-made pellet truck.

The average number of employees was 368, varying from the companies with only one employee to the bigger retailer chains consisting of even 1650 employees. Considering the question of amount of personnel, two of the responses had to be disqualified for false answers. The average sale of wood pellets was 7526 tonnes/year, varying from 15 tonnes to 170000 tonnes. In addition one of the respondents said that they only sell pellets for other than heating purposes, as litter for animals etc. Two of the responses had to be disqualified because the respondents did not know the annual amounts of the pellet sales. The total value of annual pellet sales varied between 56 euros and 33 million euros, averaging at 2143801.6 euros. Again three of the responses had to be disqualified because the respondents did not know the annual values. Also the respondent who

stated to sell only 56 euros worth of pellets annually stated to sell 260 tonnes of pellets; there can be seen a clear conflict between the sales volume in tonnes and euros. This conflict might be due to a misunderstanding or simply a minor blackout while filling in the questionnaire form.

6.2.1 Demand conditions

The first segment of the survey dealt with the demand conditions and different customer groups' importance for the wood-based pellet industries. The Table 5 presents the results from the Kruskal-Wallis test conducted. From the table can be seen the quantities of results, minimum and maximum values, the means for all of the groups and the total mean value and standard deviation. The mean ranks are displayed for all of the groups individually for a better comparison. In addition also the p-value of the analysis made is shown to highlight the significance of the variances of the study; the significant p-values are bolded. In this first segment of the survey the respondents ranked their perceptions on a scale of 1-5, ranging from "not at all important" to "very important." This segment of the survey was attached to the demand conditions of the Porter's theory described before.

Table 5: Perceptions on the demand conditions based on the survey results

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Private consumers	Housing companies	Enterprises	CHPs
Group 1	10	9	10	9
Group 2	15	15	15	14
Group 3	10	10	10	10
Min	3	1	1	1
Max	5	5	5	5
Mean 1	5.00	3.56	3.30	1.89
Mean 2	4.67	2.53	3.47	1.86
Mean 3	4.60	3.70	3.90	3.50
Mean total	4.74	3.15	3.54	2.36
Std. deviation	0.561	1.184	1.314	1.388
Mean ranks 1	21.50	21.06	16.00	13.22
Mean ranks 2	16.87	12.50	17.53	14.04
Mean ranks 3	16.20	21.80	20.70	24.55
P-value	0.181	0.027	0.554	0.009

All of the respondents stated the private consumers to be by far the most important customer group. The agreement was strong as the total mean of the responses was 4.74 and in every group of respondents the mean stayed over 4.60. The mean was especially high with the group of low sales volume companies; the mean was the highest possible, 5.00. Also some suggestive statistical significance can be found from the results as the p-value was 0.181. A strong agreement can be found within the groups concerning the enterprises as customers: the total mean was 3.54 and all of the group means stayed relatively equal to each other.

On the other hand, by far the strongest disagreements were found concerning the importance of housing companies and CHPs as customers. Considering the housing companies the firms with medium sales volumes stated surprisingly that the importance of this customer group is not of much value for them. The mean of the respondent group stayed quite low, in 2.53. On the contrary, the firms with low and high sales volumes stated that the importance of the housing companies for them is much higher, as the total means were, respectively, 3.56 and 3.70. The total mean was 3.15. When taking a look at the p-value, it reveals that the differences in perceptions

were different as a high statistical significance concerning the housing companies as customers can be found ($p = 0.027$, and the general p -value used in this study $p = 0.10$).

The situation was quite similar in comparison to the abovementioned when considering the importance of the CHPs as customers, but the statistical significance was even higher ($p = 0.009$). The significance of the CHPs was perceived considerably differently. The different perceptions can be seen also in the mean figures of the fourth proposition: the high sales volume companies stated that the CHPs are of somewhat higher importance for them as the mean was 3.50. When taking a look at the other two groups the difference can be seen instantly; the means were the lowest of the whole first question of the survey, for the low and medium volume companies, 1.89 and 1.86 respectively.

The first question also withheld the open proposition for the respondents to fill if the given propositions were not enough for them. Only a few of the respondents applied this option, but the few responses held interesting viewpoints: eleven of the respondents eventually utilized the proposition and altogether seven of them stated and wanted to specify that agriculture, farms and different kinds of gardens are especially important for their pellet business. One respondent also highlighted the importance of the wood-based pellets as an ecological choice for litter for domestic animals. One respondent also mentioned the importance of the retailers for their business. The remaining two open answers were general notifications of the survey itself.

6.2.2 Factor conditions and supporting industries

The second segment of the survey concerned the different aspects about the origin of the machinery and the final products and their significance for the wood-based pellets final consumers. Theoretically the questions in this segment were attached to the factor conditions and supporting industries as described earlier in Porter's theory. The respondents ranked their perceptions on the same scale as earlier, ranging from "not at all important" to "very important" on the scale from one to five.

Table 6: Perceptions on the factor conditions and supporting industries based on the survey results

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Domestic origin of the raw material	Renewability of the raw material	Overall raw material used	Overall domestic origin of the raw material	Domestic origin of the heating technology
Group 1	7	8	8	7	9
Group 2	13	11	12	13	13
Group 3	7	9	8	7	9
Min	2	2	1	2	1
Max	4	4	4	4	4
Mean 1	3.71	3.75	3.25	3.43	3.11
Mean 2	3.69	3.18	2.58	3.62	3.08
Mean 3	3.43	3.78	3.50	3.57	3.00
Mean total	3.63	3.54	3.04	3.56	3.06
Std. eviation	0.565	0.637	0.922	0.577	0.727
Mean ranks 1	14.79	16.75	15.94	12.07	16.17
Mean ranks 2	14.50	10.73	10.83	14.50	15.96
Mean ranks 3	12.29	17.11	18.56	15.00	15.89
P-value	0.720	0.077	0.076	0.678	0.997

As can be seen from the Table 6, the highest levels of agreement was found in the domestic origin of the raw material used for the final product, the overall domestic origin of the final product and the domestic origin of the heating technology. All of the means stayed on the medium level ranging from 3.00 to 3.70. The variation was not high and the total means for all of the questions of this segment were, respectively, 3.63, 3.56 and 3.06.

On the contrary the highest levels of disagreement were found from the propositions concerning the renewability of the raw material used for the final product and the overall raw material used for the final product (remainders, bark etc.).

The renewability for the pelletizing was surprisingly a bit underestimated by the group with the medium sales volumes, as the mean of this group was the lowest one (3.18) of all the respondent groups. Both other groups, the low and high volume, stated that the renewal content for them is of much higher value, the total means were, respectively, 3.75 and 3.78. The disagreement between the different groups can be seen also from the p-value, as $p = 0.077$ (under the general p-value 0.10 of the study). This means that there clearly is importance for the low and high volume companies if the raw material used for the pelletizing process is of renewal content or not. Also

should be noted that none of the respondents stated the renewal content to be of very low or very high importance for them as the responses stayed between two and four.

The companies with the medium sales volumes also signaled a low importance for them of the overall raw material used for the final product: the mean was the lowest of all the propositions in the second question, totaling in 2.58, which is significantly lower than the other groups and the total means. The corresponding mean figures for the low and high volume groups were, respectively, 3.25 and 3.50. The total mean was 3.04. Also the p-value was 0.076, so again a high level of statistical significance can be found. This also means that there is relevance for the low and high volume companies about which material has been used for the pelletizing process.

6.2.3 Firm strategy, structure and rivalry

The third segment of the survey concerned the different characteristics of the product for the final consumers of the wood-based pellets. The theoretical aspect was attached to the Porter's firm strategy, structure and rivalry, but also to the Garvin's marketing-based approach and its methods. The scale used in the answers was again the same, ranging from "not at all important" to "very important." The results are presented in the Table 7.

Table 7: Perceptions on the firm strategy, structure and rivalry based on the survey results

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Sales method of the product	Packaging of the product	Price of the product	Brand of the product	Logistics of the product	Services in connection with the supplies and their independence	Tailored, ready-to-use pellet heating services
Group 1	10	10	10	10	10	9	9
Group 2	15	15	15	15	15	13	13
Group 3	10	10	10	10	10	9	9
Min	2	2	4	1	2	1	1
Max	5	5	5	5	5	5	5
Mean 1	4.20	3.90	4.70	3.30	3.90	3.00	2.78
Mean 2	4.73	4.00	4.67	3.33	4.47	3.46	3.00
Mean 3	4.70	4.30	4.90	3.70	4.70	3.11	3.22
Mean total	4.57	4.06	4.74	3.43	4.37	3.23	3.00
Std. deviation	0.655	0.906	0.443	0.917	0.808	1.055	1.065
Mean ranks 1	13.65	16.10	17.25	15.65	13.00	14.39	14.17
Mean ranks 2	19.97	17.73	16.67	17.53	19.00	17.69	15.73
Mean ranks 3	19.40	20.30	20.75	21.05	21.50	15.17	18.22
P-value	0.168	0.618	0.408	0.440	0.102	0.646	0.607

Overall there were no high substantial differences in the results concerning this segment: the means remained on either the medium level or in the high-end of the scale for all of the respondent groups. The highest importance for all of the respondents had the final products price: all of the respondents claimed the significance to be high or very high as the means were for the low volume group 4.70, for the medium volume 4.67 and for the high volume as high as 4.90.

Despite the neutrality of the answers, some suggestive statistical significance was found from the aspects concerning the sales methods of the product (bulk, sack etc.) and the logistics of the product. The consecutive p-values were 0.168 and 0.102, but this time these were not statistically significant according to the Kruskal-Wallis test. In general, the low volume group stated lower significance for both of the aspects than the other two groups. The means for the low volume groups were, respectively, 4.20 and 3.90. Although being a bit lower than the other groups' means, the means of the low volume group stayed also in the medium level or in the higher end of the scale. The other two groups stated that the significance of the sales method and the logistics is of very high importance for them. In these propositions none of the respondents stated that the sales method or the logistics is not important at all.

The lowest importance for the respondent groups was in the tailored, ready-to-use pellet heating services, which was the least significant for the low volume group as the mean was only 2.78. The corresponding means for the groups with medium sales volume and high sales volume were, respectively, 3.00 and 3.22.

6.2.4 Government and other institutional acts

The fourth section of the study dealt with different aspects arising from the market environment and their importance for the final consumers of the wood-based pellets. The theoretical aspect was attached to the governmental part of the Porter's theory. The last section of this part of the survey consisted of only three propositions; the results can be seen from the Table 8. The scale used was again the same as before, ranging from "not at all important" to "very important." In this segment, all of the questions were of higher importance for the respondents; this can already be seen from how the respondents have answered as nobody stated any of the questions to be not at all important for them.

Table 8: Perceptions on the government and other institutional acts based on the survey results
(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Subsidies and the politics of the Finnish government along with other institutional acts	Prices of the raw materials	Prices of the other forms of energy
Group 1	9	10	10
Group 2	15	15	15
Group 3	9	10	10
Min	2	2	2
Max	5	5	5
Mean 1	3.56	4.20	4.20
Mean 2	3.93	4.60	4.67
Mean 3	4.00	4.90	4.90
Mean total	3.85	4.57	4.60
Std. deviation	1.004	0.778	0.651
Mean ranks 1	14.56	14.15	13.20
Mean ranks 2	17.73	18.27	18.33
Mean ranks 3	18.22	21.45	22.30
P-value	0.644	0.132	0.055

In this section the prices of the raw materials and the prices of the other forms of energy were the most important factors for the respondents. Especially the high volume group stated that these aspects were of very high importance for them, as the mean for both of the propositions were as high as 4.90. The medium volume group stated also a very high level of importance for these two propositions, as the corresponding means were 4.60 and 4.67. The low volume group had the lowest corresponding means: 4.20 in each of the propositions. Although being on the higher end of the scale, the mean of the low volume group is relevantly lower than the corresponding figures of the other two groups. Due to this, a statistical significance can be found in both of the propositions: concerning the prices of the raw materials the p-value was 0.132, this can be seen as suggestive value that the groups perceive the raw material prices and their significance for the pellet business a bit differently. In the proposition concerning the prices of the other forms of energy the statistical significance was even higher, adding up to 0.055. This is substantially lower than the general p-value 0.10 used in this study: the different groups perceive considerably differently the importance of the prices of the other energy forms.

6.2.5 Expected future demand conditions

The fifth segment of the survey asked the respondents their opinions about the importance of different customer groups for the pellet industries in the future. In this question the time-line was not defined precisely and the scale used in this question was different than the scale used before. This time the respondents ranked their perceptions on a scale from one to three; the three options were “decreases”, “will remain about the same” and “increases.” The variables were the same as in the very first segment of the study but with a different approach. Also an open question was provided for the respondents in order to support the analysis and name other important customer groups.

By the results provided by the Kruskal-Wallis test (Table 9) can be said that the analysis of this question did not provide much of substantial differences. All of the means from different groups stayed at approximately the same level. None of the means were lower than 2.0; the significance of any of the proposition groups is not going to decrease.

Table 9: Perceptions on the expected future demand conditions based on the survey results

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Private consumers	Housing companies	Enterprises	CHPs
Group 1	10	10	10	10
Group 2	15	15	15	15
Group 3	10	10	10	10
Min	1	1	1	1
Max	3	3	3	3
Mean 1	2.40	2.20	2.20	2.00
Mean 2	2.40	2.13	2.27	2.27
Mean 3	2.20	2.60	2.50	2.40
Mean total	2.34	2.29	2.31	2.23
Std. deviation	0.639	0.710	0.631	0.646
Mean ranks 1	19.00	16.50	15.70	14.40
Mean ranks 2	18.80	16.00	17.50	18.67
Mean ranks 3	15.80	22.50	21.05	20.60
P-value	0.669	0.199	0.410	0.297

Although the responses were quite neutral, the heaviest variation was seen in significance of the housing companies for the pellet industries in the future. Once again the high volume group stated the importance to be far more significant than the other groups. The mean figure for the high volume group was 2.60, whereas the corresponding mean figures for the low and medium volume groups were 2.20 and 2.13 respectively. Also somewhat suggestive statistical significance was found as the p-value was 0.199. It should be noted though that this p-value is much higher than the general p-value of 0.10 used in this study. The least important customer group in the future for the respondents seemed to be the CHPs as the total mean was only 2.23. Still this mean figure is in the higher end of the scale, which means that the respondents expect a slight increase in the importance of this group.

Like the first segment of the survey, also this segment withheld an open proposition. This time altogether 17 respondents used the opportunity to make refinements. As in the first segment of the survey, farms were a popular answer: in total six different respondents specified farms or gardens as a group of end-consumers that are going to grow their importance for the whole industry. One of the respondents narrowed down the group even more to those farmers that use straw-based pellets as litter for domestic animals. In addition, also three respondents more

claimed that customers who are using the wood-based pellets as litter are going to increase their significance highly for the industry.

One interesting open answer was also the increasing importance of the destinations of local heating that are located outside of the district heating supply network. Also one respondent claimed that the usage of the wood-based pellet is going to decrease because the price of the pellets has already climbed too high. One also wished that the Russian imports will decrease significantly and the retailer network would be enhanced. The rest of the answers were simply stating about the lack of awareness of the respondents knowledge concerning the future of the pellet industry.

6.2.6 Future importance of factor conditions, supporting industries, strategies, governmental acts and chance

The last section of the survey made a compact inquiry about the different aspects and characteristics of the final product and their importance for the final consumers. The theoretical aspect was attached to the factor conditions, supporting industries, strategies, structure, rivalry and governmental acts but also the chance aspect of Porter's theory.

The scale used for ranking the perceptions was the same as in the question before; three options ranging from one to three, "decreases," "will remain about the same" and "increases." In this section the time-span for the future was defined as the next five years. The original questionnaire form withheld altogether 14 propositions for this question. In order to provide the reader an easier task to read the results, the propositions were split in two different tables.

Table 10: Perceptions on the expected future importance of factor conditions, supporting industries, strategies, governmental acts and chance based on the survey results (propositions 1-7)

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Domestic origin of the raw material used	Overall raw material used	Overall domestic origin of the final product	Packaging of the product	Price of the product	Brand of the product	Sales method of the product
Group 1	10	10	10	10	10	10	10
Group 2	14	14	15	15	15	15	15
Group 3	10	10	10	10	10	10	10
Min	1	1	1	1	1	1	1
Max	3	3	3	3	3	3	3
Mean 1	2.40	2.30	2.00	2.30	2.70	2.10	2.30
Mean 2	2.50	2.14	2.47	2.07	2.60	2.07	2.33
Mean 3	2.10	1.90	2.20	2.20	2.90	2.40	2.50
Mean total	2.35	2.12	2.26	2.17	2.71	2.17	2.37
Std. deviation	0.597	0.591	0.741	0.453	0.519	0.618	0.547
Mean ranks 1	18.50	20.20	15.30	20.10	17.40	16.85	16.60
Mean ranks 2	19.50	17.93	20.27	16.33	16.53	16.63	17.60
Mean ranks 3	13.70	14.20	17.30	18.40	20.80	21.20	20.00
P-value	0.258	0.273	0.421	0.458	0.390	0.406	0.675

Table 11: Perceptions on the expected future importance of factor conditions, supporting industries, strategies, governmental acts and chance based on the survey results (propositions 8-14)

(Group 1 = low sales volume, Group 2 = medium sales volume, Group 3 = high sales volume)

	Logistics of the product	Domestic origin of the heating technology	Services in connection with the supplies and their independence from the pellet producers	Tailored, ready-to-use pellet heating services	Subsidies and the politics of the Finnish government along with other institutional acts	Prices of the raw materials	Prices of the other forms of energy
Group 1	10	10	9	8	10	10	9
Group 2	15	15	14	14	14	15	15
Group 3	10	10	9	9	9	10	9
Min	2	1	1	1	1	1	1
Max	3	3	3	3	3	3	3
Mean 1	2.50	1.90	1.89	2.00	2.20	2.50	2.44
Mean 2	2.47	2.07	2.07	2.36	2.50	2.60	2.80
Mean 3	2.50	2.10	2.22	2.78	2.56	3.00	3.00
Mean total	2.49	2.03	2.06	2.39	2.42	2.69	2.76
Std. deviation	0.507	0.664	0.564	0.615	0.792	0.530	0.502
Mean ranks 1	18.25	16.25	14.17	10.75	14.10	15.70	13.00
Mean ranks 2	17.67	18.53	16.57	15.61	18.25	16.20	17.30
Mean ranks 3	18.25	18.95	18.72	21.28	18.28	23.00	20.50
P-value	0.982	0.768	0.451	0.027	0.429	0.067	0.067

Overall the responses for this section between different respondents were quite scattered, as can be seen from the Tables 10 and 11, but none of the total means sank under 2.00. In general, none of the significances of the variable groups is going to decrease in the near future.

According to the results, the price of the product is going to be especially important for the pellet industries in the next five years. The group of the high sales volumes defined the product price with a mean figure of 2.90 as very important for them. The corresponding mean figures for the low and medium sales volume groups were 2.70 and 2.60 respectively.

Also the prices of the raw materials and the prices of the other forms of energy were considered as very important for the wood-based pellet industries in the near future. Especially the high volume group stated the growing significance of these two proposition groups by having the highest mean figure possible, 3.00. The other two groups also stated the importance of the prices of the raw material and prices of the other energy forms. The corresponding mean figures were a

bit more scattered for these groups, as the figures were for the raw material price 2.50 and 2.60 respectively and for the prices of the other energy forms 2.44 and 2.80 respectively. Still, the importance can be seen to be substantial also for the low and medium volume groups.

By far the highest statistical significance of the last segment was found from the proposition dealing with the tailored, ready-to-use pellet heating services: the p-value was 0.027. The disagreement can be seen easily also from the mean figures of the proposition: the group with the low sales volumes stated that the importance will stay about the same (mean figure 2.00) but the group with the highest sales volumes stated that the significance of the tailored pellet heating services will most likely increase in the near future (mean figure 2.78). The group with the medium sales volumes came in between the two other groups with a mean figure of 2.36. Also in the question concerning the raw material prices and the prices of the other energy forms the statistical significance was quite high, as the p-values were 0.067 both: the different respondent groups perceive the importance of the propositions quite differently.

The least important aspects for the respondents in the near future were dealing with the domestic origin of the heating technology and the services in connection with the supplies and their independence from the pellet producers. In these propositions the lowest mean figures were found from the respondent group with low sales volumes, respectively for the two propositions, 1.90 and 1.89. Also the total mean figures stayed at a modest level, 2.03 and 2.06 respectively.

6.3 The future importance of additional services for wood-based pellets sales, services and distribution – the open questions

In the next question the respondents were asked that from their point-of-view, what kind of services related to the wood-based pellet industry could increase their importance in the future. The answers for this question were scattered in many directions, but one future solution gained more ground than the others: altogether nine responses out of the total 33 stated that the importance of tailored, ready-to-use pellet solutions is going to increase significantly in the future. In addition to the question shown already earlier (the importance of the tailored, ready-to-use heating solutions) the respondents stated that also the pellet logistics, delivery and maintenance

could be tailored and even automatically done in the future. This way the ease of use would be optimal for the end-user. The respondents would like to see also longer-term delivery contracts.

Concerning the logistics the respondents stated also that in the future the importance of the small sacks and their deliveries to the final customer is going to increase significantly. One respondent even stated that there would be significant need for a pellet producer, who would have a moving pellet extractor. This way the usage and manufacturing would be easier for example to small-scale sawmills.

The respondents also claimed that in the future the pellet services could give out more information about the wood-based pellets as an alternative for heating; at the moment the awareness is still lacking among the bigger masses.

Two of the respondents stated that the usage of the wood-based pellets as litter for domestic animals is going to increase in the future. The rest of the open answers were basically stating that they are lacking awareness concerning the future wood-based pellet services.

In the next question the respondents were asked about their opinions regarding which kinds of services or products are still lacking at the moment from the wood-based pellet industries. The answers to this question were quite similar to the previous. The answers were scattered, but some themes can be picked up. Altogether 12 of the respondents stated the same as earlier that the tailored, ready-to-use services and especially automatic deliveries and maintenance services are lacking at the moment although there would be a clear request for these services and the model could be easily adapted from other European countries.

Another theme that was clearly stated was the unawareness of the pellet as an option for the heating purposes. The respondents said that even at a governmental level the information about pellets and their purposes could be enhanced. Also the marketing of the wood-based pellet services and products was found to be inadequate. The rest of the responses to this open question simply said that the current state of the domestic wood-based pellet industry is sufficient, or that the respondents are lacking awareness to answer this question.

The next question asked the respondents if the customers are asking for different kinds of services in relation to the wood-based pellets. The answers were again quite similar to the responses earlier, but also some interesting differences and new aspects were found. According to the

respondents most of the queries in relation to the wood-based pellets are related to the logistics, deliveries and maintenance of the pellet burners and silos. Still, according to the respondents, most of the pellet customers do not ask separately for pellet-related services. Some of the respondents specified clearly that this is due to the fact that domestic pellet business is still in a minor role, and most of the people who use the wood-based pellets for heating purposes are self-educated pioneers who often know more about the pellet procedures than the sales personnel.

The last question of the whole survey asked the respondents about the customers' willingness to pay for the additional pellet services. The opinion was quite clear: altogether 12 of the 18 responses stated that the customers are not willing to pay for the additional services. According to the respondents, some of the unwillingness is also due to the fact that many of the end-users are still doing a lot of the services and maintenance by themselves as the domestic pellet industry is still quite young and undeveloped.

Also some flickers of hope were seen among the responses: four of the respondents believed that there is willingness to pay when it comes to the additional services. Two of these positive respondents specified that the willingness can be found only with the right kinds of services with the right prices.

The questionnaire form also withheld a final open field for the respondents to make statements about the domestic pellet trade in general. This field was utilized only by few respondents, but still some great observations were done. One of the respondents stated again that the awareness of the wood-based pellets is still in really bad shape and should be enhanced. One also claimed that sadly geothermal heating solutions and air sourced heat pumps have overtaken the ground from the wood-based pellet solutions. The same respondents noted though that the end-users who have converted to the pellet solution are highly satisfied.

7. Discussion and conclusions

The current state of the European forest industry and the pulp and paper business is not very admirable. The whole industry is in need for new and innovative ways of utilizing wood. Also the price development of the emissions trading business is likely to direct more of the pulp wood and the sawn wood by-products to be used for energy production.

In order to diminish the CO₂ emissions in the future and to achieve the goals set for Finland in the Kyoto Protocol and the RES-E Directive the domestic usage of renewable wood-based bioenergy will have to be enhanced. To do so, also the pellet industries will have to ensure that the product itself, but also the whole chain of handling is of first class: top-level raw material and final product without the knowledge of the customer behavior and their needs will not ensure the competitiveness among the other energy sources.

Inspired by the abovementioned, the primary objective of this study was to take a look at the emerging markets of the wood-based pellets in Finland and to reveal the consumer thoughts concerning the pellet consumption. Another aim was to create a concise SWOT analysis of the strengths, weaknesses, opportunities and threats of the domestic wood-based pellet industry. In the first phase of the study a literature review was implemented to gain knowledge regarding the subject being studied. The topic was introduced along with the purpose and implementation of the study, but this phase also made the grounds for the SWOT analysis and the design process of the survey and the questionnaire. The second phase of the study was composed of an online survey made for the pellet producers and retailers. The survey e-form was eventually sent to 872 recipients. As stated earlier, the number of final entries did not match the potential as only 39 recipients answered to the survey. The response rate remained at 4.5%. The results of the survey illustrate at general level the issues on which the pellet producing companies and retailers could focus in their marketing and strategic management when aiming at developing their business.

As this study was first of its kind in Finland, the findings from the literature review were helpful in order to create the SWOT analysis and the questionnaire for the survey but also to increase the general understanding of the emerging wood-based pellet markets in Finland. The study was conducted around the SWOT analysis, Porter's model of competitive advantage and the selected

parts of Garvin's marketing approach. The theoretical base also made the grounds for the whole survey conducted in the study.

The SWOT analysis based on the literature review revealed that almost all of the strengths of the domestic wood-based pellet industries are related to either different kinds of ecological aspects or different kinds of raw material related issues. This was also supported in the results of the survey: the respondents claimed that the domestic origin and renewability of the raw materials being used are of higher importance for the end-users, but also some discordant notes could be seen in the responses. Especially the group of respondents with medium level annual sales volumes stated that neither the renewability nor the material used for the pelletizing is of higher importance for them. The usage of the wood-based pellets can be expected in the near future as the environmental awareness of the different kinds of energy end-users will increase.

The wood-based pellets are a relatively new form of source of energy and also the pellet business seems to be still in an early phase of development in Finland. The popularity among the end-users was for a long time based on the relatively cheap prices and according to the results of the survey the private consumers seem to be by far the most important customer group for the companies of all sizes. During the recent years the prices have climbed and diminished the price advantage, and also the subsidies from the Finnish government have been mostly inadequate. In addition with the results provided by the SWOT analysis, these factors were also emphasized in the survey results: the retailers who answered to the questionnaire stated that one of the most significant factors in the future of the wood-based pellets is going to be the prices of the raw materials which eventually affect heavily also the price of the final product. The high volume companies stated the prices in the future to be extremely important; this might be due to the fact that the large-scale end-users are more price sensitive than for example the private consumers whom in general have no alternatives to react on rapid changes of energy sources, unlike the large-scale users whom mostly utilize pellets combined with coal and can rapidly reduce their amounts of pellets being used.

By the survey results it is obvious that the prices of the raw materials and prices of the other energy sources are going to be in a crucial role in the future. Also some differences were seen within the groups: the low volume group did not value the prices as much as the others. This might be due to smaller amounts of distribution for mainly the private consumers.

The general price development along with the different incentives from the government and other institutional actors can affect either negatively or positively to the state of the Finnish pellet trade and markets. The price development and different kinds of enhancements in the legislation and information about the pellet industries will be in key role if the abovementioned environmental awareness towards the ecological pellet choice is wanted to be promoted as a reasonable solution for energy-effective heating. The large-scale users have already been interested in the utilization of the wood-based pellets to diminish their CO₂ emissions and other pollution. This has to be done also regarding the small-scale usage mostly among the private consumers. If the knowledge is not enhanced and the whole industry is not made to look like a reasonable and cheap-enough option, there is a risk that other forms of energy and heating technologies will totally run over the whole Finnish pellet industries. A good example of this came up in the open questions of the survey form: one of the respondents stated that the heat pumps have already run over the wood pellet heating systems, much because of the indecisiveness of the Finnish government. One of the respondents also stated that the general knowledge of the wood-based pellets and their environmental friendliness has to be promoted more by the government and other actors. This same aspect came out very clearly also from the SWOT analysis.

To enhance the usage of the wood-based pellets it would be crucial to state for the bigger masses that wood is no longer a messy and dirty choice for energy which needs a lot of manual labor. In order to do so, the model could be learned quite easily from Sweden or Austria where the development have made the whole society more pellet-friendly. As stated by Hakkila (2006) the competitiveness of the wood-based pellets and other wood-based fuels could be enhanced by increasing the prices of other energy forms via different carbon-based taxing, as already has been done in some scale. This, in addition with the reasonable subsidies provided by the government could easily enhance the situation of the Finnish pellet industries. Despite the carbon-based taxation system the price of the wood-based pellets is still remaining in a level which is too high. One of the respondents stated that the usage of the wood-based pellets is unfortunately going to decrease in the near future as the price development has still been in favor for the non-renewable fuels; this is much due to the Finnish government.

Also according to the results of the survey the biggest obstacles at the moment for the Finnish wood-based pellet industry are related to the aforementioned governmental acts and subsidies, or more specifically to the lack of them. As stated also in the SWOT analysis the governmental actions

to support the production of the domestic energy are highly inadequate. With subsidies and tax reductions as in some other EU countries the energy consumption could easily be adjusted to the direction of renewal sources. This would lead to enhance the domestic employment situation but also to increase the general awareness of the pellet industries and other Finnish bioenergy sources. This notion was also supported in the survey results of the study: all of the respondents agreed that the governmental acts are important for the end-users. The respondents stated that in the future the situation is going to remain about the same, but the significance of the governmental acts was a bit more important for the companies of the larger scale. The political acts could obviously enhance the situation of the domestic pellet markets as has happened in many other EU countries (Verhoest & Ryckmans, 2012; Peksa-Blanchard et al., 2007).

According to the SWOT analysis of this study one of the main challenges for the wood-based pellets in the near future seem to be also the development of new raw materials and the pellet logistics: as the domestic sawmilling industry seems to be diminishing their capacity the pellet industries will eventually have to come up with new kinds of solutions for the raw materials. The focus of the research concerning the pellet scene will have to be directed more towards the reasonable future raw materials. This would ensure the price stability of the wood-based pellets but also promote the Finnish labor. By this also the information and trust among the possible small-scale users would be promoted. In the survey all of the respondents stated the same as the SWOT analysis brought up: the different aspects about the final product and its domestic origin were highly valued. It seems that in the future the domestic origin of the wood-based pellets is going to increase even more.

On the contrary, the renewability factor of the wood-based pellets was underestimated by the medium-scale survey respondents. Rest of the respondents valued the renewability as much more important. According to the results of the whole study and the survey the importance of the ecological factors, including the renewability is going to increase in the future. If this aspect is still been underestimated, the bigger masses might turn for other producers in order to get a more ecological product. The medium-scale companies did not consider the overall raw material used for the final product as an important factor for their pellet business. In the long run this may reflect as a lack of R&D concerning the new raw materials which could obviously be seen also in the prices of the end-products. This could also provide grounds for a competitive advantage for the smaller and higher sales volume companies.

The whole European pellet markets are mostly prevailed by surplus and the Finnish markets are also affected heavily by the Russian wood tariffs and wood imports (VAPO Oy, 2012). Also the Russian price level is on a totally different stage than the Finnish level. If the imports of the cheaper Russian raw material and final product rise in the future, this could easily mean new decreases and heavy adjustments concerning the domestic wood-based pellet production. Furthermore, the decrease of the pellet production would lead to lay-offs and terminations. But still, the Russian imports, especially concerning the raw materials, can also be crucial for the whole industry in the future: if the industry does not come up with new raw material solutions the lack of adequate raw material can lead to delays concerning the forthcoming pellet plants as there is no guarantee for the raw material supply. In order to gain more ground from the European market area the Finnish pellet manufacturers and retailers could establish more sales offices around the EU; this is something that did not come up in the SWOT analysis, but in the survey results only a minimal amount of the respondents stated to have offices also abroad. The sales offices abroad could give a specific competitive advantage for the domestic pellet companies.

There is also one external factor that is even more critical for the customers now and in the future: the price related issues. The notifications from the SWOT analysis was again supported by the survey results as all of the respondents ranked the importance of the current price of raw material and current price of other energy forms as crucial for the demand of the wood-based pellets. Obviously, as noticed also in the literature review and SWOT analysis of the study, the climbing prices of other energy forms will make the bigger masses interested in the usage of wood-based pellets. Concerning the future a strong agreement was found within all of the respondent groups that the prices of the raw materials, prices of the other forms of energy and the price of the final product itself is going to be very important in the near future. To prevent the prices of the wood-based pellet from climbing too high the raw material sources will have to be ensured; this could be done by increasing the general awareness of pellets as a heating option. If the awareness would be higher, then bigger masses and companies would also be interested in making new innovations and finding new solutions that would enhance the whole industry in Finland.

An interesting conflict was found in the survey results of the study: at the moment all of the respondents seemed to state a lower importance for the tailored, ready-to-use pellet heating services, but especially the high volume companies stated that the need of this kind of service is going to increase heavily in the future, whereas the low volume companies did not give much of

significance for this new kind of business model. In the earlier studies this model of wood-based pellet industries was not emphasized, but seemingly could bring a lot of new aspects for the whole industry. Also the usage of the wood-based pellets as litter for domestic animals was emphasized especially in the open fielded questions. The same aspect was also discussed earlier in the literature, but the significance of this model of usage is doubtful as the need for pellets in this kind of small-scale actions is supposedly of minor class.

Based on the analysis made from the survey responses it is clear that companies of different sizes value different things and this should be noted also when thinking about different retailer chains and managing the marketing solutions. The private households were very important for all of the respondent groups, but for the respondents whose company had the lowest annual sales volumes the significance were especially important. This might be due to the fact that usually the smallest companies do not have the opportunity for the economies of scale which would be needed in order to serve the biggest end-user groups (CHPs, enterprises) that need a lot of wood-based pellets for the bigger solutions. This same pattern can be seen to repeat itself when taking a look at the importance of the CHPs as final customers: their significance for the low and medium sales volume companies is mostly unimportant but for the high volume companies this group is more significant: it seems that the bigger players need bigger supporters. On the other hand the housing companies as end-users had the least significance for the companies of the medium sales volumes. This might be due to the low potential seen in the housing companies, as in Finland not so many housing companies have been converted to the usage of the wood-based pellets. One explanation could also be that the housing companies are using different kinds of pellet heating systems and burners which can also utilize the industrial pellets, therefore the price of the better quality pellets from the low and medium volume companies could climb too high.

On the contrary, the smaller companies have bigger potential towards the niche-markets: the smaller size allows, but also forces, the companies to adapt and find new ways to serve the customers via better solutions, for example in services. The smaller companies are more flexible and can serve the end-users more personally; this could be taken advantage of for example in the logistics of the wood-based pellets as the survey revealed that the small-scale producers do not pay attention at the moment to the different opportunities in developing the sales methods. Eventually the small-scale producers could specialize themselves in smaller sales quantities; the open answers revealed also that there is potential in the sack deliveries but there is not too much

companies doing these deliveries in Finland. The smaller companies could also adapt themselves for the tailored and ready-to-use pellet services, for example with complete services from maintenance and assemblies to pellet deliveries for smaller scale end-users. By these more complete wood pellet services also the general information and awareness of the whole industry would be rising to a whole new level. In this case also the significance of branding the wood-based pellets could bring new market potential for the pellet producers; the brand could be, for example, attached to the ready-to-use pellet services and marketed this way in a more complete way to the end-users.

According to the survey results the significance of the domestic pellet heating technology is of lower scale. This was also supported by the SWOT analysis and the literature review: the Finnish wood-based pellet users are not dependent on the domestic heating technology and therefore there is a lack of domestic manufacturers. The heating technology is usually easier and cheaper to import from abroad.

The survey results in the open questions emphasized the importance of agriculture as the wood-based pellet end-users, but also another interesting group as pellet users came out: the local heat plants that are outside of the district heating network. These are interesting viewpoints for strategic aspects of different companies: the farms and gardens could be a promising customer group with new market potential especially for the smaller scale producers as the contracts could be negotiated long but the amount of pellets needed is not too high, and the local heat plants could be easily operated by the larger scale companies as the amount needed is higher. The ready-to-use pellet services could be especially valuable for the farms and gardens; this way they could concentrate on doing their own business.

Perhaps the most important messages signaled by the survey results were the importance of adequate subsidies and favorable taxation policies, prices of the product and the raw material. Despite being an ecological choice, the green aspects were not especially emphasized in the survey answers. This array signals that most of the wood pellet end-users are still heavily price oriented and will most likely make their choices based on only the current and expected price development of the energy sources. Therefore the governmental maneuvering plays a major role and can shift the energy consumption towards a greener economy with different subsidies for the

forest-based energy sources and heavier taxation for the non-renewable sources. This would also lead into more advanced general knowledge concerning the pellet industries.

Based on the responses claimed in the last part of the survey, the open questions, it seems also that even the different retailers are disagreeing about the future guidelines, but still one theme was clearer than the others: the ready-to-use, tailored pellet heating services. The respondents stated also that even the pellet logistics, delivery and maintenance could be done automatically by the companies in the future. This is a clear continuum in the service society as the end-users want to have the easiest possible solution ready to be used. The industry wants to be promoted from DIY twiddling into a more precise business. As stated earlier this is a strategic aspect for all of the pellet companies worth thinking about. Even the model could be easily adapted from other European countries. In general it can be said that the wood-based pellet producers could think about the service solutions more. From the marketing point-of-view the whole pellet industry is not doing much in order to promote itself. One explanation for this can be that the general awareness is lacking but still the marketing organizations could do more to enhance the situation of the industry in Finland.

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Appendix 1

Covering letter for the survey form

Hyvä pellettejä myyvän yrityksen edustaja,

Puupellettimarkkinoihin liittyvän tiedon avulla voidaan etsiä käytännön keinoja sekä pellettien toimitusketjujen liiketoimintamahdollisuuksien edistämiseen että suomalaisen bioenergiatuotannon kasvattamiseen. Liiketoiminnan lisäksi puupohjainen bioenergian käyttö luo mahdollisuuksia edistää alueellista hyvinvointia erityisesti Suomen metsätalousvaltaisilla alueilla.

Puupellettisektorin kuluttajamarkkinoita on toistaiseksi tutkittu hyvin niukasti. Tämän kyselyn tarkoituksena on tutkia pelletinvalmistajien ja pellettejä jälleenmyyvien yritysten näkemyksiä erityisesti suomalaisten puupellettimarkkinoiden nykyisestä tilasta sekä mahdollisista tulevista kehityksen painopisteistä. Kyselyn tulokset tuottavat uutta tutkimukseen perustuvaa käytännön tietoa suomalaisten puupellettiliiketoiminnan ja sen asiakaslähtöisyyden kehittämiseen.

Tämä kysely on osa Helsingin yliopiston metsätieteiden laitoksen metsäteollisuuden johtamisen ja markkinoinnin alalla käynnissä olevaa Pro gradu-tutkimusta. Työn tarkoituksena on laaja-alaisesti kartoittaa puupellettien kuluttajamarkkinoita Suomessa sekä niiden nykyisiä asiakastarpeita, tulevaisuuden odotuksia ja yritysten kilpailukyvyyn edistämismahdollisuuksia. Työn ohjaajana toimii yliopistonlehtori (MMT, dos.) Katja Lähtinen metsätieteiden laitokselta.

Kaikki tähän kyselyyn tulleet vastaukset kerätään ja analysoidaan täysin luottamuksellisesti, eikä yksittäisten yritysten tai henkilöiden tietoja luovuteta ulkopuolisille. Kaikille vastaajille toimitetaan tutkimuksen valmistuttua sähköpostitse tiivistelmä Pro gradu-työn tuloksista. Tulokset esitetään siten, ettei niistä ole mahdollista tunnistaa yksittäisten kyselyyn osallistuneiden yritysten ja henkilöiden tietoja.

Kiitän lämpimästi osallistumisestanne jo tässä vaiheessa. Mikäli haluatte lisätietoja, vastaan mielelläni mahdollisiin kyselyä koskeviin kysymyksiinne.

Markus Joas, metsätieteiden ylioppilas

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Helsingin yliopisto, maatalous-metsätieteellinen tiedekunta

Metsätieteiden laitos

PL 27 (Latokartanonkaari 7)

00014 Helsingin yliopisto

Appendix 2

The survey form

Background of the company

1. The name of Your company:
2. The form of Your company:
3. Does your company do business in several locations?
- ☐ Yes, only domestic ☐ Yes, both domestic and abroad ☐ No, only one location
- ☐ The location of your office:
4. The headcount of the employees of Your company in Finland:
5. Your position in the company:

Basics concerning the wood pellet trade of your company

6. Your company trades pellets (please fill one or multiple):
- ☐ Domestically ☐ Abroad
7. Your company trades pellets (please fill one or multiple):
- ☐ As a retailer ☐ As a producer
8. What is the ratio (%) of the domestic and foreign pellets traded yearly in Your company?
- Domestic
- Foreign
9. How much Your company trades wood-based pellets per year (tonnes)?
10. How much Your company trades wood-based pellets per year (euros)?

11. Your company trades pellets in:

- ☐ Small sacks ☐ Large sacks ☐ Bulk
- ☐ Other, how?



The current state of the wood-based pellet trades

12. From the viewpoint of Your company, how important are the following end-user groups for the pellet trade:

**** Private consumers ****

- ☐ Not at all important ☐ Somewhat unimportant ☐ Not important, but not insignificant ☐ Somewhat important ☐ Very important ☐ I cannot say

**** Housing companies ****

- ☐ Not at all important ☐ Somewhat unimportant ☐ Not important, but not insignificant ☐ Somewhat important ☐ Very important ☐ I cannot say

**** Enterprises ****

- ☐ Not at all important ☐ Somewhat unimportant ☐ Not important, but not insignificant ☐ Somewhat important ☐ Very important ☐ I cannot say

****CHPs****

- ☐ Not at all important ☐ Somewhat unimportant ☐ Not important, but not insignificant ☐ Somewhat important ☐ Very important ☐ I cannot say

****Other, which?****



13. From the viewpoint of Your company, how important the origin of the following product and technology attributes are for the end-users:

****The domestic origin of the raw material used for the final product****

- | | | | | |
|--|--|--|--|--------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important |
|--|--|--|--|--------------------------------------|

****The renewal content of the raw material of the raw material used for the final product****

- | | | | | |
|--|--|--|--|--------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important |
|--|--|--|--|--------------------------------------|

****The overall raw material used for the final product (remainders, bark etc.)****

- | | | | | |
|--|--|--|--|--------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important |
|--|--|--|--|--------------------------------------|

****The overall domestic origin of the final product****

- | | | | | |
|--|--|--|--|--------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important |
|--|--|--|--|--------------------------------------|

****The domestic origin of the heating technology****

- | | | | | |
|--|--|--|--|--------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important |
|--|--|--|--|--------------------------------------|

14. From the viewpoint of Your company, how important the following product attributes are for the end-user:

****Sales method of the product (bulk, sack etc.)****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Packaging of the product****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Price of the product****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Brand of the product****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Logistics of the product****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Services in connection with the supplies and their independence from the pellet producers****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****Tailored, ready-to-use pellet heating services****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

15. From the viewpoint of Your company, how important the following aspects arising from the market environment are for the end-users:

****The subsidies and the politics of the Finnish government along with other institutional acts****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****The prices of the raw materials****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

****The prices of the other forms of energy****

- | | | | | | |
|--|--|--|--|--------------------------------------|------------------------------------|
| ☐ Not at all important | ☐ Somewhat unimportant | ☐ Not important, but not insignificant | ☐ Somewhat important | ☐ Very important | ☐ I cannot say |
|--|--|--|--|--------------------------------------|------------------------------------|

The estimated future trends of the Finnish pellet industry

16. How would You estimate the future importance of the following end-user groups:

****Private consumers****

- | | | |
|---------------------------------|--|---------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases |
|---------------------------------|--|---------------------------------|

****Housing companies****

- | | | |
|---------------------------------|--|---------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases |
|---------------------------------|--|---------------------------------|

****Enterprises****

- | | | |
|---------------------------------|--|---------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases |
|---------------------------------|--|---------------------------------|

****CHPs****

- | | | |
|---------------------------------|--|---------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases |
|---------------------------------|--|---------------------------------|

****Other, which?****



17. How would You estimate the future importance of the following characteristics and aspects of the product for the end-user groups:

****The domestic origin of the raw material used for the final product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****The overall raw material used for the final product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****The overall domestic origin of the final product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****Packaging of the product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****Price of the product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****Brand of the product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****Sales method of the product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****Logistics of the product****

- | | | | |
|---------------------------------|--|---------------------------------|------------------------------------|
| ☐ Decreases | ☐ Will remain about the same | ☐ Increases | ☐ I cannot say |
|---------------------------------|--|---------------------------------|------------------------------------|

****The domestic origin of the heating technology****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

****Services in connection with the supplies and their independence from the pellet producers****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

****Tailored, ready-to-use pellet heating services****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

****The subsidies and the politics of the Finnish government along with other institutional acts****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

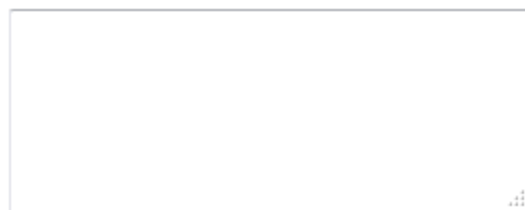
****The prices of the raw materials****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

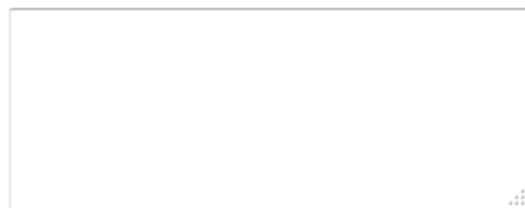
****The prices of the other forms of energy****

- ☐ Decreases ☐ Will remain about the same ☐ Increases ☐ I cannot say

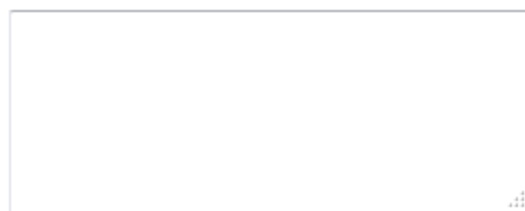
18. From the viewpoint of Your company, what kind of services related to the wood-based pellet industry could increase their importance in the future?



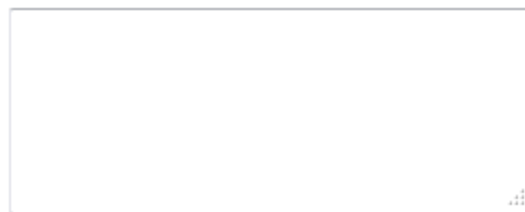
19. From the viewpoint of Your company, which kinds of services or products are still lacking at the moment from the wood-based pellet industries?



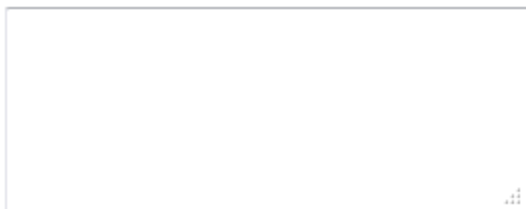
20. Are the customers asking for different kinds of services in relation to the wood-based pellets?



21. Are the customers willing to pay for the additional pellet services?

A large, empty rectangular box with a thin black border, intended for a response to the question above. In the bottom right corner, there is a small, faint icon consisting of several small dots arranged in a triangular pattern.

Free comments:

A large, empty rectangular box with a thin black border, intended for free comments. In the bottom right corner, there is a small, faint icon consisting of several small dots arranged in a triangular pattern.

Thank you for your participation!