

## Outlook on mechanical wood processing in Estonia

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<b>Abstract</b> This report aims to describe the current situation of Estonian mechanical wood processing, giving separate production overviews of sawn wood, planed wood, plywood, veneer, fiberboard, particle board, wooden carpentry, wooden furniture and prefabricated wooden houses. Estonia is highly forested and the wood processing sector is an important employer. The mechanical wood processing sector has an important role in Estonian economy and in export of goods. The recent economic recession has reshaped most of the industry, forcing companies to increase efficiency and improve their position in export markets.			
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<b>Other information</b>			

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## 1 Introduction and background information

### 1.1 Forest resources, ownership and fellings

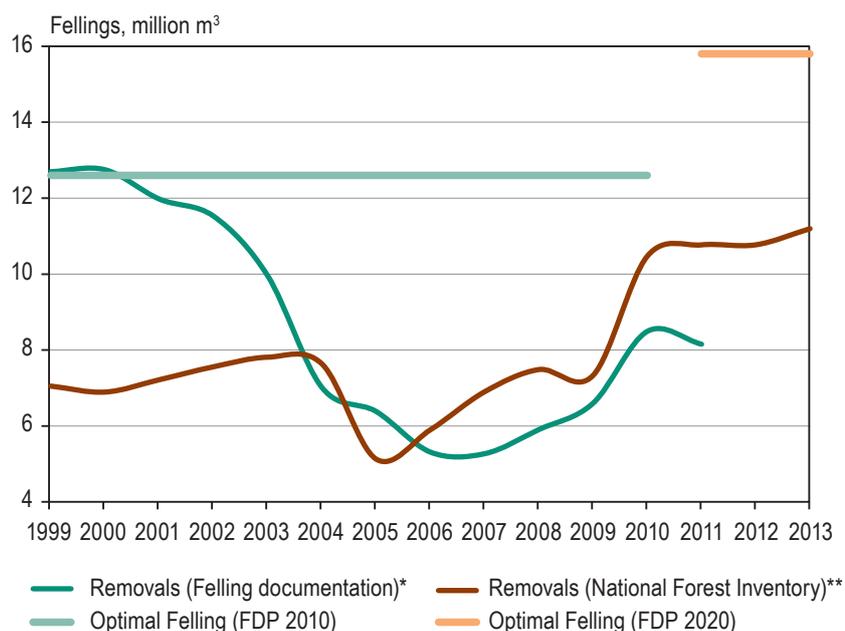
According to Pärt *et al.* (2013) 50% of the land in Estonia or 2.21 million hectares is covered with forests and the growing stock is estimated at 458 million m<sup>3</sup>. Growing stock per capita and level of forestation is higher than in most EU27 countries. About one fourth of the forest land is under strict protection or managed with restrictions.

Forest ownership is as followed: 45% private forests (34% owned by physical persons and 11% owned by juridical persons), 40% state forests and they are managed by the State Forest Management Centre (RMK) and 15% forest land subject to privatization. In 2010 there were 97 272 private forest owners, 96% of them are physical and 4% are juridical persons, who owned respectively 74% and 26% of private forest land. Average forest land ownership amongst physical persons was 11.3 ha and 90.3 ha for juridical persons. Around 40 000 physical persons own 0.1–5 hectares, covering 10% of private forest land and approximately 19 000 own 5–10 hectares, covering 13% of private forest land (Valgepea and Maamets 2013). The more forest (both in terms of size and properties) owners have the more likely their prevailing management motive is selling wood for income. Ownership of small forest areas can cause lack of interest in forest management within private owners, resulting in economically less valuable stands and reduction of fellings (Põllumäe *et al.* 2014).

Main tree species by land area in state forests are *Pinus sylvestris* 43%, *Betula pendula* 30% and *Picea abies* 21% followed by *Populus tremula* 3%, *Alnus incana*, *Alnus glutinosa* and other species 3%. In private forests the main tree species are *Betula pendula* 38%, *Pinus sylvestris* 24% and *Picea abies* 17%, followed by *Alnus incana* 11%, *Populus tremula* 6% and other species 4% (Pärt *et al.* 2013). Estonia has good growing conditions for birch and it often accompanies spruce in mixed forests. Abundance of birch and grey alder in private forests can be explained by natural reforestation or insufficient attention to early thinnings when birch and grey alder often outgrow coniferous trees.

Also an important factor influencing the market is the average age of stands. The average age has been relatively stable for the last decade. The average age of Norway spruce has declined from 60 in 2000 to 58 in 2010 and for Scots pine it has increased from 70 to 72 in the same time span. Although, when looking at a longer time period, the average age of Norway spruce and Scots pine have both increased significantly. Since 1975 the average age has increased by 10 years for Norway spruce and by 20 years for Scots pine. The main reason behind this is that annual increment has usually exceeded harvesting volumes (Pärt *et al.* 2013). It has become a common issue in the Nordic countries that forests are not harvested intensively enough and many stands start to lose their economic value if they are over matured.

The main type of harvesting in Estonia is clear cutting. About 75% of volume originates from clear cuttings and 22% from thinning and sanitary cuttings (Merenäkk *et al.* 2013). Optimal felling volume according to Estonian Forestry Development Program (FDP) until 2010 was 12.6 million m<sup>3</sup>, which was also sustainable considering the annual increment of 12 million m<sup>3</sup>. The current Forestry Development Program (FDP) until 2020 has raised the optimal harvest level to 15.8 million m<sup>3</sup>. This exceeds the calculated annual increment, but at the moment there are plenty of old growth forests that need to be harvested in order not to lose wood quality in the future (Purret 2014).



**Figure 1.** Removals, annual increment and felling volumes in Estonia (Statistics Estonia 2014, Purret 2014).

\* Removals according to official felling documentations

\*\* Removals according to National Forest Inventory

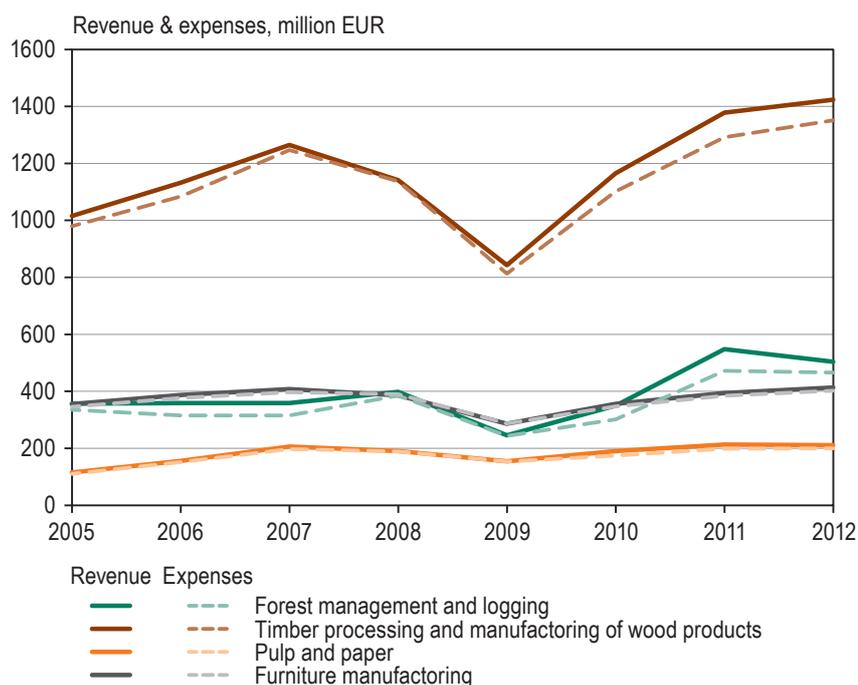
There are different felling volumes in Figure 1 depending on the sources. National Forest Inventory numbers are based on inventories exercised in the forests reflecting what areas and dimensions have been cut. Felling documents, however, also include cuttings that were planned, but might not have been executed on that particular year (Purret 2014).

The share of different tree species in harvesting volumes from the last decade have been: 35% Norway spruce, 22% Scots pine and 19% Birch. When looking from the perspective of the sawmill industry, then sawlogs (diameter > 18 cm) are mostly received from Norway spruce (40%) and Scots pine (37%) and small logs (diameter < 18 cm) from Scots pine (39%) and Norway spruce (38%). Birch and Norway spruce produced the most pulp wood, both about 36% (Merenäkk *et al.* 2013).

## 1.2 Importance of the mechanical wood processing sector

Estonian manufacturing industry grew steady in the years of 2000–2007, doubling in size. The production declined during recession years, in 2010 it started to recover and by 2011 it had reached a new record level. 2011 was a successful year to Estonian economy by having the highest economic growth in EU (7.6%). The manufacturing sector is currently the biggest employer in Estonia, recruiting every fifth person, with biggest industries being metallurgy, wood processing and food industries (Raudsaar *et al.* 2013).

Most wood processing companies survived the crisis thanks to export and the domestic consumption recovery in 2011 as well. Production grew 17% and sales 19% during 2010–2011 (Raudsaar *et al.* 2013). Timber processing, pulp and paper and furniture production constituted to 22% of the manufacturing industry in 2011. This illustrates the importance of wood processing to the Estonian economy, as this share is almost three times higher than the average EU-27 index. The



**Figure 2.** Estonian forest and wood cluster sales revenue and expenses in 2005–2012 (Statistics Estonia 2014).

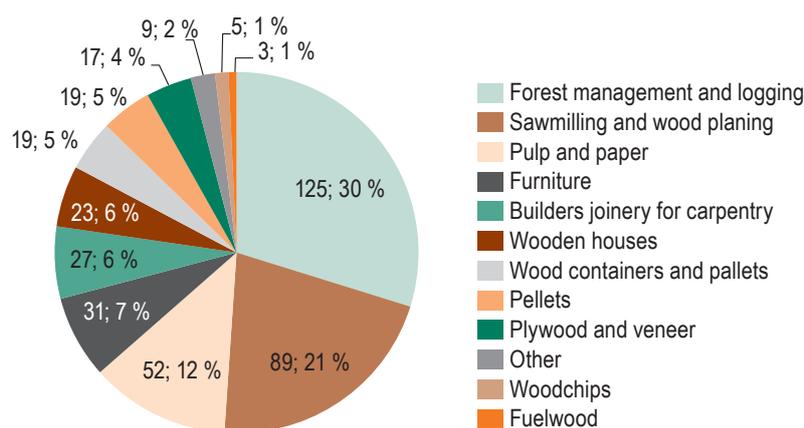
share of wood processing industries in the whole manufacturing sector has stayed above 20% in the last 10 years in Estonia, being surpassed only by Latvia (Tamm and Tiits 2013).

Wood processing, furniture and wooden house manufacturing companies increased their export values in 2010 by 44% and in 2011 by 17%. Wood and wood products constituted to 8% of the whole export value in 2011. The most important products were sawn timber and construction details. The main export destinations were Sweden (19%), Finland (19%) and Germany (10%) (Raudsaar *et al.* 2013).

Import of wood and wood products grew 16% in 2011, constituting 2.3% of the whole import. Sawn timber made up 49% of the wood and wood products import. The most important import countries were Russia (33%) and Latvia (26%). However, more than half of the imported wood and wood products used to originate from Russia before the recession (Raudsaar *et al.* 2013).

In 2009 sale revenues of forest and wood cluster declined the most in forest management and timber processing industries. The sector was most affected by changes taking place in export. Local consumption declined as well due to the rapid decrease of construction activities. Furniture production and the paper industry also lost revenue but not in the same scale as timber processing and forest management (Figure 2). Estonian forest and wood cluster sales revenue has now recovered from the decline of 2008–2009 and has exceeded the pre-recession level. Forest management and logging companies have had the fastest recovery of them all (Tamm and Tiits 2013).

Timber processing, pulp and paper and furniture production make almost one quarter of the manufacturing industries added value, but different business activities have different shares. The largest share of added value in 2011 belonged to forest management and logging companies (Figure 3). However, worth to keep in mind that it includes the State Forest Management Centre (RMK) that produces half of the sectors added value (62 million EUR). Forest management and



**Figure 3.** Estonian forest and wood cluster added value by fields of business in 2011 (million EUR, %) (Tamm and Tiits 2013).

logging industry were followed by sawmilling and wood planing (21%) and pulp and paper industry (12%) (Tamm and Tiits 2013).

Although the amount of workforce in the Estonian forest and wood cluster has declined by almost 10 000 people compared to figures from 2003, it still remains a significant employer with around 28 000 employees (Tamm and Tiits 2013).

Timber processing, pulp and paper and furniture production have a very important role in Estonian economy. This sector has had a steady share of more than 20% of the added value within the national manufacturing industry for over 10 years. Estonia has one of the highest shares in total added value (3.5% in 2011) from timber processing, pulp and paper and furniture production in the Baltic Sea region (Raudsaar *et al.* 2013). Productivity of companies operating in this sector, however, is still three to four times lower than the average Nordic companies' (Tamm and Tiits 2013).

## 2 Sawn wood

### 2.1 Background

Most sawmills during the Soviet regime did not concentrate on one specific product; they were considered universal, selling roundwood as well as some end-products. The production was mainly used by cooperatives and kolhozes<sup>1</sup>. A similar trend continued in the early years after privatization of the wood industry in 1990s. Sawmills were not able to pay competitive sawlog prices, thus majority of the raw material went to export. The industry grew persistently with continuous investments into modernizing the production (Purret 2014).

During the 1990s the biggest exporter of wood was AS Sylvester, who opened their first and that time the largest sawmill in Imavere. This was later sold to Stora Enso in 2002 and is still the largest

<sup>1</sup> Kolkhoz was a collective farm in the Soviet Union that was operated as a production cooperative

operating sawmill in Estonia with production volumes reaching 400 000 m<sup>3</sup> (Purret 2014). The industry has gone through a remarkable development as the national sawn wood production grew from 353 000 m<sup>3</sup> (1995) to 1.45 million m<sup>3</sup> (2010). At the same time export of sawn wood grew from 34.4 million EUR to 180 million EUR (Kaarna 2013).

Nowadays most sawmills have merged together to form bigger corporations or have been bought by large foreign concerns. Smaller sawmills have started specializing on niche products or have made investments to move their end product from sawn wood to higher value added products (Kaarna 2013).

## 2.2 Raw material

Sawmills utilize wood mainly from Estonia in a 100–150 km radius around the production mill. Some companies located in South Estonia also use timber from Latvia if it's economically feasible. As it can be seen in Table 1, the total amount of imported roundwood has declined drastically and thus sawmills are now more dependent on local logging activities. Russian roundwood used to be a significant source of raw material, however due to Russia implementing increasing custom taxes on round wood export in 2007 the import has almost stopped completely. Further on, the October railroad that was used for transporting logs from Russia has gone into repairs and is still out of use (Kaarna 2013).

Reduction of imported roundwood has raised the dependency on local wood production. The State Forest Management Centre (RMK) is managing public forests well and is the most important supplier of logs in Estonia. However, private forest owners have approximately 45% of the forest land, but their interest in managing and harvesting forests is declining due to small land ownership and loss of interest in rural activities. Therefore sawmills can suffer lack of supply (Kaarna 2013).

Although, formally, roundwood prices are set by sawmills, the real reason behind the rise in prices is shortage of supply. The usual purchasing price-competition starts in autumn when supply of

**Table 1.** Export and import of industrial roundwood in 2002–2011 (Raudsaar et al. 2013).

Country	Export, m <sup>3</sup>									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sweden	1 533 170	1 286 846	1 144 546	863 509	670 013	764 518	851 743	556 550	1 109 223	1 210 547
Finland	871 942	978 403	637 046	573 867	679 591	591 081	595 126	451 156	836 558	987 482
Germany	200 410	159 824	11 924	6 902	29 436	4 089	1 450	7 631	100 868	216 442
Norway	484 305	554 756	487 384	328 384	212 934	113 986	10 819	55 293	158 430	136 161
Latvia	1 997	390	725	29 116	8 088	781	6 203	7 684	38 209	35 288
Austria	854	577	834	1 235	2 721	713	977	796	704	712
Denmark	229	2 885	296	1 503	292	1	152	126	24	184
Country	Import, m <sup>3</sup>									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Latvia	25 599	16 274	15 402	72 178	102 708	75 388	205 142	207 719	249 240	314 940
Russia	529 237	851 012	1 387 259	1 608 331	1 660 252	1 188 351	147 463	24 032	11 357	6 447
Finland	1 698	366	1 172	29 417	942	22 040	7 651	567	3 141	5 105
Ukraine	1 241	1 963	1 955	3 690	3 581	6 369	67 941	13 699	28 481	4 734
Lithuania	1 890	28 603	6 399	1 418	738	16 931	72 541	13 133	4 645	2 496
Poland	1 342	926	1 666	705	1 324	1 984	1 216	1 186	1 196	2 094
Sweden	14	5 282	4 763	149 360	27 822	106 465	58 380	1 706	553	13

roundwood is at its lowest. Sawmills with the biggest shortage of supply and most financial funds start to raise the log price and that eventually influences the other sawmills to follow the trend. This raises the commonly accepted roundwood prices to a new level in a few weeks. Thus, the increase of procurement prices only increases the supply temporarily. One method sawmills use to counteract the purchase price-competition are bonus schemes. If the supplier manages to supply a required amount of timber set in a contract then it will get an incentive pay. This means that the supplier doesn't need to sell timber to the highest bidder to get the most profit by the end of the contract period (Kaarna 2013).

Sawmills get about 30–50% of their raw material from RMK. This large share has also had a positive effect on the industry because RMK reacted to the financial crisis quite fast, lowering the log prices and helping the local sawmills survive the crisis more easily than some in Nordic countries. Due to lack of raw material, some sawmills have also started to purchase forest land to ensure better supply. However, this is not yet a common trend (Kaarna 2013).

## 2.3 Production and export

It must be noted that majority of the bigger sawn wood companies are branches of Finnish or Swedish corporate bodies. For example, Stora Enso Eesti owns sawmills in Imavere and Näpi and Toftan sawmill is owned by AB Karl Hedin. Sawmills Aegviidu Puit, Viiratsi Saeveski and Viru-Nigula Saeveski are owned together by Estonian companies Rait AS and Lemeks AS (Raitwood 2014). Laesti AS owns two sawmills (Sauga and Savi) in Pärnu with combined production capacity of 100 000 m<sup>3</sup> (Laesti 2014). Metsä Group is currently in the process of selling their Metsä Wood Eesti sawmill in Reopalu to Estonian Combimill (Sorainen 2014). This trend of being purchased by larger companies or merging together with other competing mills can be seen with many small sawmills in order to stay competitive.

The loss of Russian raw material had an effect on the production and export of sawn wood, thus many companies had to decrease production already in 2007. Partially this might have softened the effects of the 2008 financial crisis. Later, most companies have restored their volumes to pre-recession times or have even increased in production (Kaarna 2013). The largest current sawmills can be seen in Table 2. The production volumes are approximate numbers and may vary from year to year.

**Table 2.** Annual production of largest sawmills (Stora Enso 2014, Toftan 2014, Vara Saeveski 2014, Raiwood 2014, Metsä Group 2014, Laesti 2014).

Owner	Sawmill	Production, m <sup>3</sup>
Stora Enso	Imavere	350 000
	Näpi	75 000
AB Karl Hedin	Toftan	200 000
Rait AS, Lemeks AS	Viiratsi	100 000
	Aegviidu Puit	50 000
	Viru-Nigula	50 000
Vara Saeveski	Vara	90 000
Combimill	Reopalu	84 000
Laesti AS	Sauga	50 000
	Savi	50 000

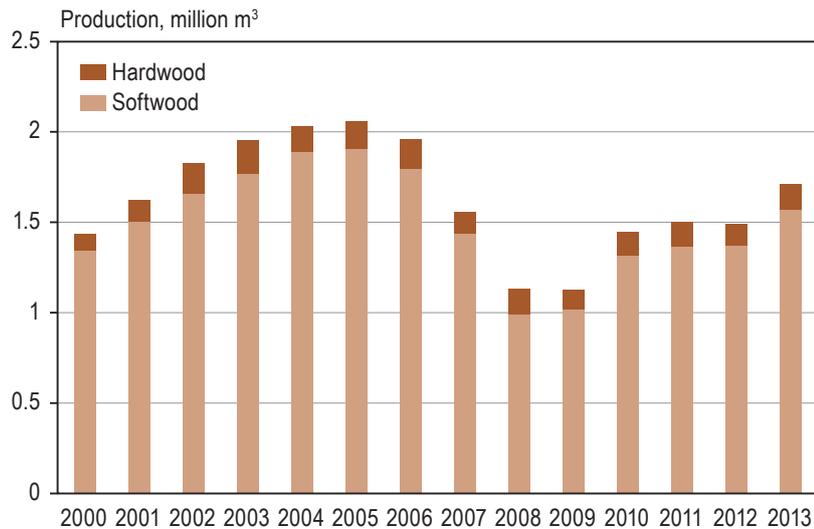


Figure 4. Production of sawn wood in Estonia 2000–2013 (Statistics Estonia 2014).

Standard measurements of sawn wood are: 16, 19, 22, 25, 32, 38, 44, 50, 63, 75, 100, 125, 150 mm times 50, 75, 100, 125, 150, 200, 225 mm. These dimensions are at 20% moisture content. Sawn wood is sorted according to the Nordic standards, mostly based on the so called ‘blue book’, but some companies also use the ‘green book’. For example A1 class pine lumber is 4–5 times more expensive than C class spruce lumber (Riistop 2003).

Sawn wood exports possess 16–17% of the total wood products export. As seen in Figure 4, the majority of the production is from softwood. About half of the production is exported (Kaarna 2013).

The main export destinations are Finland, United Kingdom and Germany. Total value of sawn wood exports in 2012 was roughly 184 million EUR. There has been an enormous drop in exporting wood to United Kingdom. Exports to Australia, Latvia, Japan and Netherlands have increased in recent years (Figure 5) (Purret 2012).

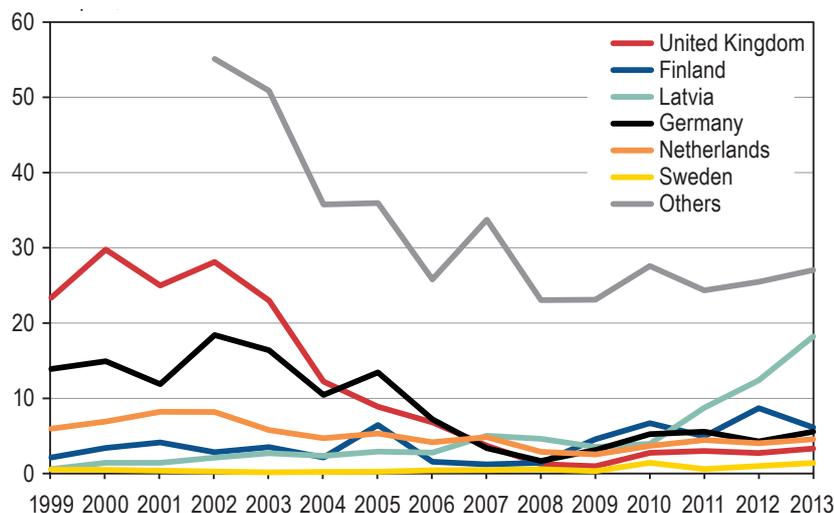


Figure 5. Sawn wood export markets (Eurostat 2014).

According to 2011 figures, the largest exporter of sawn wood to UK was Sweden, followed by Finland and Latvia with three times lower volumes. Germany imported the most sawn wood from Sweden, Russia and Austria. Finland imported the most from Russia (59%) and Estonia (12%). Estonian companies exported their products in general with cheaper prices than Swedish and Finnish competitors, but with a bit higher price than Latvia (Kaarna 2013).

Foreign market is seen as the main factor affecting demand. For example, while the paper industry was growing in Nordic countries, the export of pulp wood was growing fast and it also raised the prices of sawlogs. Even economic activities as far as North America are presenting opportunities for Estonian companies.

Sawmills survived the economic crisis better than for example planing mills. There was no large reduction of staff and loss of domestic demand was made up with increased exports. Most companies had to lower prices but production capacities stayed the same. Larger companies didn't lower wages but rather tried to optimize costs from other factors. Mostly common steps that were made to survive the crisis were: improving product quality (2/3 of companies), lowering prices (1/2 of companies), launching new products to the market (1/3 of companies) and refreshing the marketing methods and sales channels (Kaarna 2013).

Import of sawn wood is discussed in supply of raw material for the planing industry.

## **2.4 Investments**

Sawmills have invested mostly in automation of production and improving sawn wood output. Many companies believe that they could improve production capacity by 10–20% without doing any major investments. However, many companies don't see increasing production as the main goal (Kaarna 2013).

Main investments in recent years have been made in 3D scanning and in the machinery responsible for turning the log into the right position in pre-cut stage. The idea is to sort the logs into assortments as soon as possible and cut each log according to its characteristics. Investments have also been made in image scanning to sort sawn wood more accurately into quality classes. The purpose of automation is to reduce the importance of human decisions in the production process. Workers would rather be left with the responsibility of controlling and maintaining the automated machinery. This means that in the future, workers wouldn't need to be educated in making production based decisions, but they need to be more educated in operating complicated machinery (Kaarna 2013).

Some sawmills have invested in extending the value adding chain. For example Stora Enso Eesti has concentrated its production around Imavere Sawmill. In Imavere they have the largest glulam beam factory in Estonia and in 2012 they also started a pellet factory. Viiratsi Saeveski, Aegviidu Puit and Viru-Nigula Saeveski have received investments from planed wood producer Raitwood and forest management and logging company Lemeks (Kaarna 2013).

### 3 Planed wood

#### 3.1 Raw material

The raw material for planing mills is sawn wood. Most of the raw material comes from Estonian sawmills. However, in order to fulfill necessary quality assortment and measurement needs, some of the sawn wood has to be imported due to the nature of the local timber and the characteristic of Estonian sawmills (Kaarna 2013).

Planing mills have very high requirements for their raw material and thus they cannot rely only on the Estonian sawmills. Some quality classes can be difficult to obtain from the local forests and sometimes it is easier to import from other countries. In addition to high requirements, shortage of sawn wood is affecting the industry in some cases, keeping in mind that planing mills are not the only consumers of sawn wood. Getting raw material from different sources helps to mitigate risks. Some companies deliberately won't buy more than 50% of raw material from one source. Most companies see delivery time and conditions as the bottlenecks of supply (Kaarna 2013).

Russia is undoubtedly the most important source of imported sawn wood for Estonia. Unlike sawlogs, sawn wood is transported from Russia to Estonia with trucks. However, depending on the supplying company, the supply chain can be very erratic (especially delivery times). Most companies agree that long term partners are reliable but they cannot order vital cargo loads from Russia because of uncertain delivery times. However, regular raw material supply can still be ordered from Russia, if the delivery time can be flexible (Kaarna 2013). Half of the Estonian sawn wood import comes from Russia (82 million EUR in 2012). Less significant exporters to Estonia are Finland, Latvia and Sweden (Figure 6). Sawn wood import (159 million EUR) constituted to about 43% of all wood products imports in 2012 (Purret 2014).

Sawmills have the upper hand in price negotiations with planing mills at the moment due to lack of required quality sawn wood available in the market. The sawing companies are taking advantage of this situation and taking a disproportionally large share of profit margins. Also, sawmills make

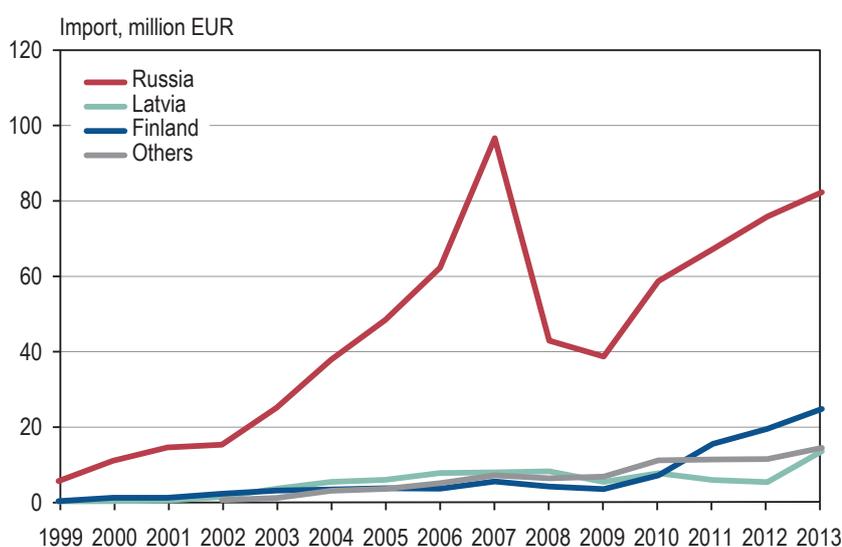


Figure 6. Import partners of coniferous sawn wood import (Eurostat 2014).

1–3 month long contracts with planing mills, but at the same time planing mills usually have one year fixed price contracts with their customers (Kaarna 2013).

### 3.2 Production and export

Total production values are difficult to obtain because many small factories produce planed wood for their own consumption in further products. Most companies produce only according to purchasing contract, some are also serving retail customers, so they also produce to stock. List of the largest producers can be seen below (Table 3).

Financially difficult times for the post-processing industries began with the building boom when price of sawn wood began to rise rapidly. Planed wood producers couldn't raise the prices at the same speed as sawmills. Sawn wood prices got lower during recession years, thus the postprocessors could generate bigger profit margins in 2008. However, in 2009 the demand was already significantly lower and many companies had net losses even with cheaper raw material (Kaarna 2013).

Planed wood exports were worth about 58 million EUR in 2012. Continuously shaped wood is mainly exported to Norway, with significant increase from 6 million EUR in 2009 to 19 million EUR in 2012.

In 2011 Estonia exported planed wood mostly to Norway (28%), Finland (16%) and South Korea (7%). Average price was the lowest of these three in South Korea. Finnish price was more than two times and Norwegian price almost three times higher than in South Korea (Kaarna 2013).

Estonia has the second biggest share of Norway's imported planed wood with 22% after Sweden (39%). Estonia is the biggest supplier to Finland (43%), biggest competitors are Germany (13%) and Latvia (10%). Main suppliers to South Korea in 2011 were China (28%), Indonesia (27%), Malaysia (13%), Latvia (10%) and Estonia (7%) (Kaarna 2013).

Some planed wood producers have started looking for better sales channels in new markets because Estonia has too big share of the market in the Nordic countries. In many cases cooperating with many different dealers in the Nordic countries result in competing for the same end users. Despite

**Table 3.** Annual production of largest planing mills (Stora Enso 2014, Raitwood 2014, Puidukoda 2014, Tapa Mill 2014, Balcas 2014, Lotus Timber 2014, Höövelliist 2014, Vesset 2014, Nordlum 2014, Vara Saeveski 2014).

Company	Production, m <sup>3</sup>
Näpi Saeveski	130 000
Raitwood	75 000
Puidukoda	65 000
Tapa Mill	50 000
Balcas	25 000
Lotus Timber	24 000
Höövelliist	12 000
Vesset	12 000
Nordlum	9 000
Vara Saeveski	4 000

a large share of the market, producers say that they don't shape the prices. According to the average export price, Estonian companies have managed to get better value for their products than the Swedish and Latvian competitors. Many companies see the Asian markets as a big opportunity, because it is cheaper to send a container to China than for example a truckload to France. However, Asian culture is much different and understanding their expectations and needs is going to take time (Kaarna 2013).

Continuously shaped wood products don't have a significant share in total import figures (only 2% of all sawn wood products). Main import partners are Finland, Germany, Sweden, Latvia and Lithuania (Purret 2014).

### **3.3 Investments**

Planing mills have mostly invested in additional value adding processes. Usually this means adding primary coating and painting lines (Kaarna 2013). Painting lines need relatively many workers but due to high productivity it increases the product profit margin and at certain quantities it is also cheaper for the end user to buy a ready-made, painted product than to do the work themselves. In addition to that, being able to provide a wider variety of products and increasing flexibility of services is essential for staying competitive.

Production lines are usually rather updated or slightly improved, rather than investing in completely new equipment. One problem is that most machinery providers are not familiar with the companies' specialized production decisions and it is easier to hire and educate few production mechanics who can tune the production line in order to get higher productivity out of it (Kaarna 2013). Also, because of a large variety of products, the processing line has to be flexible and able to produce high quality products. Best quality class products can be twice as expensive as lower quality planed wood, thus the main issue is still maintaining production quality. Many companies have also invested in additional thermoplastic packaging for high quality products.

## **4 Plywood, veneer, fiber- and particle boards**

### **4.1 Background**

Production of particle boards started already in 1950s in Narva Mööblivabrika and in Tallinna Taarakombinaat. Plywood production began at the end of the 19th century in A. M. Luther plywood and furniture factory (Kaldur 2013). A. M. Luther was one of the first of its kind in Europe and their water-resistant plywood probably the first in the world (Riistop and Muiste 2012). A. M. Luther produced veneer and plywood for the local furniture industry. National production of veneer and plywood stayed low until the end of 1990s (Kaldur 2013).

According to data from 2011 there were ten companies whose main activity was producing fiberboards, particle boards, veneer or plywood. Half of them are established on foreign investments (Kaldur 2013).

## 4.2 Raw material

Veneer and plywood factories use roundwood as raw material. Logs are purchased at standard lengths, cut into optimum measurements and then rotary cut into veneer sheets. Fiber- and particle board producers buy some share of raw material from local sawmills (sawdust and woodchips). However, roundwood is still the main source because then the companies can control the quality of input by doing the chipping or shaving processes themselves (Kaldur 2013).

Estonia has good growing conditions for birch. Birch has the second largest growing stock (26%) in Estonia after pine (38%) (Raudsaar *et al.* 2013). Veneer, plywood and wood panel producers buy their raw material mainly from Estonia in a radius of 100–150 km around their factories. This is considered as an optimal transportation distance for keeping the cost of input reasonable. Small amount is also purchased from Latvia, Lithuania and Ukraine. Import of Russian roundwood had a large share in some companies before the implementation of increasing custom taxes in 2007 (Kaldur 2013).

Panel producers say that the quality of raw material is good or very good. There were some problems only in the first years of operation but now that they have long term supply partners, the quality standards are well established and followed by the suppliers. The price of raw material is influenced rather by panel producers than suppliers (Kaldur 2013).

Veneer, plywood and panel producers find the current price of raw material rather good and stabilized. The biggest problem for panel producers was the increase of biofuel usage in Estonia. This kept raising the woodchips price till 2013 when a large power plant in Narva stopped using woodchips. With one of the largest energy producing plants in Estonia not competing for the raw material anymore, the price has since decreased by 15% (Kaldur 2013).

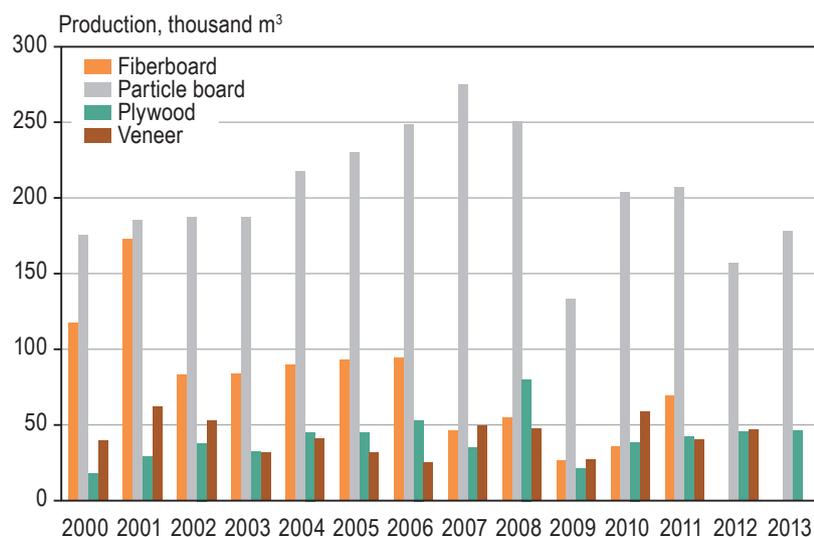
Veneer log supply is thought to stay stable at least for the next few years. Raw material consumption for veneer and plywood has also reached an optimal stable level at the moment (with restarted production of veneer in Kohila Veneer OÜ in 2012). The panel industry's raw material availability is projected to worsen and the price to increase due to increased biofuel usage (Kaldur 2013).

## 4.3 Production and export

The largest production is particle board, followed by other products on quite similar level (Figure 7). Fiberboard production had a significant share from 1995 (109 000 m<sup>3</sup>) to 2001 (172 000 m<sup>3</sup>). Production volume has since decreased a lot due to reduction of hard fiberboard production from 2002–2007 and since 2008 hard fiberboards are no longer produced (Raudsaar *et al.* 2013). Skano Fiberboard OÜ still produces soft fiberboards in two factories in Pärnu and Püssi.

Sales revenue of the five largest companies (Repo Vabrikud, UPM-Kymmene Otepää, Balti Spoon, Skano Fiberboard and Valmos) made 91% of the sectors turnover in 2011 (Kaldur 2013). Table 4 lists the current largest producers.

Kohila Veneer (previously owned by Baltic Panel Group) used to produce plywood but went into bankruptcy in 2008 (Tere 2011). In 2011 Kohila Veneer was bought by Latvian Finieris, the following year about 9 million EUR was invested in new equipment and in 2012 it already started



**Figure 7.** Production of plywood, veneer, particle and fiberboard (Statistics Estonia 2014, Raudsaar *et al.* 2014).

**Table 4.** Annual production of largest plywood, veneer, fiber- and particle board factories (Repo Vabrikud 2014, Skano Fiberboard 2014, Valmos 2014, Tarmeko Spoon 2014, Balti Spoon 2014, Kohila Vineer 2014, Riistop and Muiste 2012).

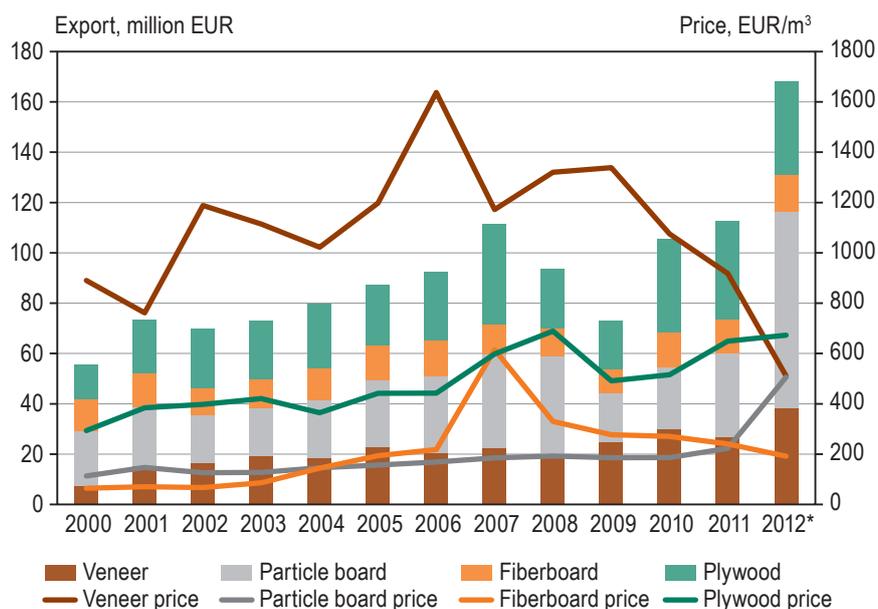
Company	Production, m <sup>3</sup>
<b>Particle board</b>	
Repo Vabrikud	200 000
<b>Fiberboard</b>	
Skano Fiberboard (Pärnu and Püssi mill)	110 000
<b>Veneer</b>	
Kohila Vineer	75 000
Valmos	22 000
Tarmeko Spoon	25 000
Balti Spoon*	30 million m <sup>2</sup>
<b>Plywood</b>	
UPM-Kymmene Otepää	50 000

\*Balti Spoon reports their production volumes only in m<sup>2</sup>

producing rotary veneer for the Latvian concern. Estimated input is 120 000 m<sup>3</sup> of birch logs with 60–70% yield. Production of plywood should start soon (Kohila Vineer 2014).

UPM-Kymmene Otepää factory was established in 2000 by AS Forestec, AS Sylvester and UPM-Kymmene. In 2003 UPM-Kymmene acquired all the shares of the mill. The machines were second hand, but they were thoroughly renovated and new components were added over the years. Now it is one of the most modern plywood factories in Europe considering labor and energy consumption per m<sup>3</sup> (Riistop and Muiste 2012).

Repo Vabrikud chipboard plant was established in 1974 to utilize low quality and small diameter wood from the local forest that were turned into oil shale mines. Since 2005 its new owner is Sorbes AG. Its main product is melamine faced chipboard (2/3). It is the largest producer of MFC boards in the Northern Europe (Riistop and Muiste 2012).



**Figure 8.** Export of veneer, plywood, fiberboards and particle boards (Raudsaar *et al.* 2014)

\* The sudden increase in particle board value in 2012 could be a statistical error

Veneer and plywood producers were less affected by the financial crisis than particle and fiberboard producers that also started competing with energy producers for the raw material. Particle and fiberboard producers switched the focus to market sectors that were thought to come out of the recession faster (Kaldur 2013).

Largest companies export 90% of their production (Kaldur 2013). Overall export values and export unit prices can be seen in Figure 8. The sudden increase of veneer export volume and decrease of price was caused by Kohila Veneer that started production in 2012 and forwarded all of its production to Latvian Finieris. Plywood production has stayed stable and the price has grown steadily over the last decade.

Estonia exports veneer mostly to Poland (23%), Slovakia (14%), Germany (12%) and Lithuania (11%). Main export destinations for the plywood industry are Germany (45%), Sweden (11%), Finland (6%), Norway (5%) and Turkey (4%) (Kaldur 2013).

Particle board products are mainly exported to Finland (30%) and Sweden (30%). Estonia is the largest exporter of particle boards to Finland by volume. It is followed by Latvia with 25% less and Germany with 2.5 times less volume. Estonian export has the fifth place in Sweden at equal level with Latvia. Largest exporters to Sweden are Norway and Germany who both export about four times more particle boards in volume than Estonia (Kaldur 2013).

Fiberboards are exported the most to Finland (28%), Norway (18%), Russia (12%), Sweden (12%) and Germany (10%) (Kaldur 2013).

## 4.4 Investments

Recent largest investments have been made by Latvian Finieris into the Kohila Veneer factory. In 2011 about 6 million EUR was invested in machinery and components. A new peeling line, log and by-products handling lines were ordered from a Finnish manufacturer Raute Corporation (Lesprom 2011). In 2012 additional 12 million EUR was invested (Kald 2012). Kohila Veneer markets its products through Latvian Finieris, only the byproducts are sold domestically.

UPM-Kymmene Otepää increased its production from 25 000–50 000 m<sup>3</sup> in 2007–2008 by adding another peeling line. Approximately 10.5 million EUR was invested in the machinery. In 2008–2009 2 million EUR was invested to improve post-treatment operations. Heat treated lamination (FORM, WIRE) and cold lamination (Multiwall, Multifloor) machinery lines were installed. In 2010 post-treatment was further improved (Jukk 2010).

Further development of the sector relies largely on product demand in different fields and how Estonian producers manage to position themselves there. UPM-Kymmene Otepää has switched focus from construction to logistics sector (e.g. truck trailers, trains, buses, gas tankers). Fiber- and particle board manufacturers are looking into the future rather carefully. Most companies don't make longer plans than five years, although many of them have recovered their production capacity to pre-recession years (Kaldur 2013).

Establishment of new companies is rather unlikely as the domestic consumption is very low and huge investments are needed for setting up production and establishing marketing channels. Fixed costs in the cash flow are high and raw material competition is dominated by a small number of large companies (Kaldur 2013).

## 5 Wooden carpentry

### 5.1 Background

Wood carpentry sector has a wide range of products. There are more than 200 companies with 3 000 employees producing wooden windows, internal and front doors, window- and doorframes, doorsteps, stairs and railings, etc. Wooden window and door manufacturing makes 90% of the sales turnover in the wood carpentry sector and 80% of its workforce. Thus, this report focuses on these two products (Saarma 2013).

The background of leading companies is diverse. There are subsidiaries of some of the largest door and window manufacturers in the world, descendants of soviet era companies and companies established on domestic or joint capital. This sector began expanding during the second half of 1990s when machinery was modernized and consumption started to grow rapidly (Saarma 2013).

### 5.2 Raw material

Main input materials are processed wood, glass, hinges, knobs and paint. Largest input item is processed wood (glulam) which is mainly bought from Estonia. Most companies are satisfied

with the quality of wood and delivery times of the suppliers. However, Estonian glulam beam producers sell their products according to the global price level. This doesn't give the door and window manufacturers a competitive advantage with the input expenses. Most of the companies also purchase wood from different countries due to requirements of different assortments and because of seeking out better prices. Input wood is imported from Finland and Baltic states. Most producers believe that the price of input material is going to rise in the next four years (Saarma 2013).

Glass is imported mostly from Latvia and Lithuania, the main reason is cheaper price. Knobs and hinges are bought from local resellers or imported. The main factor here is customer preferences on design (Saarma 2013).

### 5.3 Production and export

Usually companies use only 70% of their production capacity and the volumes fluctuate according to the season. Production is in full capacity at peak times, working in multiple shifts. Largest companies are listed in Table 5. Ten largest manufacturers (less than 5% of all companies) produce 80% of this sectors turnover and the five largest cover 80% of all export (Saarma 2013).

**Table 5.** Annual production of largest wooden door and window manufacturers (Vikind Window 2014, Haapsalu Uksetehas 2014, Aru Grupp 2014).

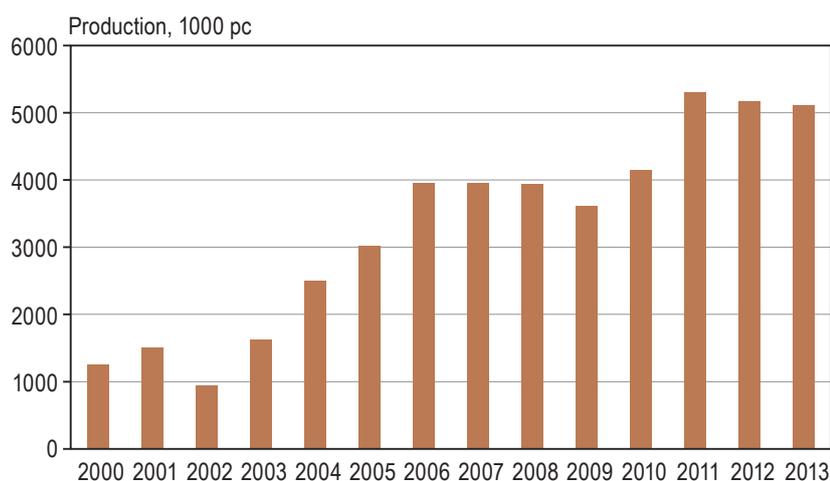
Company	Production
Viking Window	12.5 million EUR
Haapsalu Uksetehas	8.4 million EUR
Aru Grupp	5 million EUR
Viljandi Aken ja Uks*	-
JELD-WEN Eesti*	-
JNA Aknad ja Uksed*	-
Fenestra*	-

\*Company doesn't make this information public

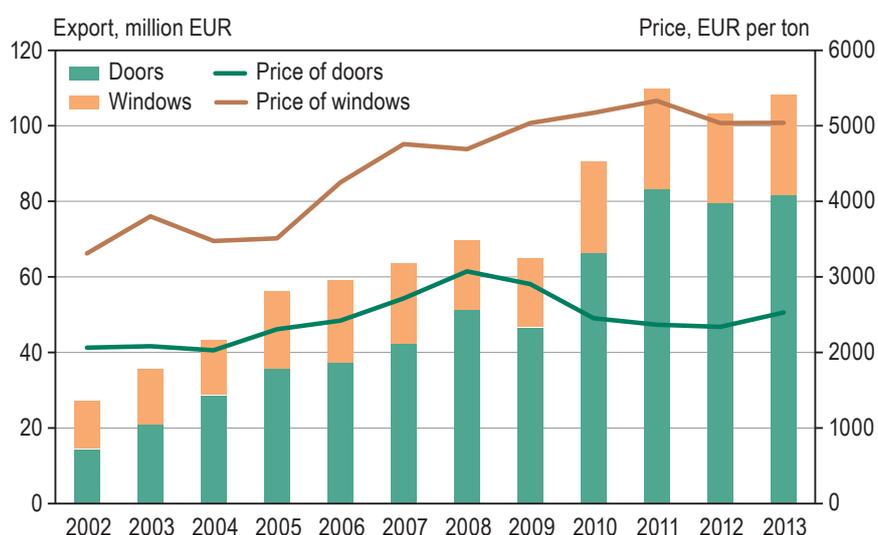
Production of wooden doors and windows has had one of the fastest growths in the industry. Production has grown around 13% per year on average, with a temporary stop during economic recession (Figure 9). The recession was managed thanks to increased local production of prefabricated houses, CO<sub>2</sub> quota projects and renovation constructions from KredEx<sup>2</sup> subsidies (Saarma 2013).

In recession years companies had to reevaluate their management plans and try to make production more efficient. This created good foundation for increasing profitability and sales revenue later on. As seen in Figure 10, door manufacturers lowered their prices to 2005 level and maintained production volumes, window producers on the other hand have kept increasing prices and lowered the export share. Estonian companies export about 70% of their production (Saarma 2013).

<sup>2</sup> Fund KredEx was founded in 2001 by the Estonian government. Today, KredEx has evolved to a financial group helping Estonian enterprises, apartment associations and private persons by offering grants, loans, venture capital and credit insurance (KredEx 2014)



**Figure 9.** Production of wooden doors and windows in 2000–2013 (Statistics Estonia 2014).



**Figure 10.** Export of wooden doors and windows 2002–2013 (Eurostat 2014).

Estonian wooden door export has increased its share in the global market from 0.6% to 3.6% in the last ten years. Export volumes have grown on average 22% per year (Figure 7). The main export markets are Sweden, Denmark, Finland and Norway. Together they make 80% of the export. Comparing different exporters in these markets Estonia was 1st/2nd in Sweden, 3rd in Denmark, 1st in Finland, and 2nd in Norway. In 2011 Estonia was globally 10th and in Europe 5th largest exporter of wooden doors (Saarma 2013).

Export of Estonian wooden windows has increased its global share from 1.5% to 2.2% in ten years. Main export markets are Sweden, Finland, Denmark and Norway. In 2011 Estonia was the largest exporter in Sweden and Finland. The main competitors in Sweden are Poland, Finland and Latvia. In Finland the biggest competitor countries are Sweden and Germany (Saarma 2013).

The general tendency is that Estonian manufacturers sell their products for 20–30% cheaper than their Nordic competitors. This creates a competitive advantage but makes further investing difficult due to smaller profit margins. The price is on the same level with other Eastern European

manufacturers but the quality is considered to be better. The reality is that the product prices need to rise if labor and raw material costs keep rising. Many companies find it important to focus on trademark marketing, improving quality and moving sales channels closer to the end consumer (Saarma 2013).

## 5.4 Investments

Most companies prioritize on moving into new markets and improving cooperation with current and potential resellers. Internet sales are commonly not seen as a sector worth investing in. Stricter EU regulations on building energy efficiency are a hope for the door and window manufacturers to increase sales on higher quality products. Demand on fire and noise resistant doors and windows are also expanding. One scenario the producers are worried about is that customers will demand products with more functionality for the same price (Saama 2013).

Increased demand and rising salaries motivate companies to invest in machinery. Most manufacturers find improving production machinery to be the number one goal. New machinery is needed for increasing production, improving quality and delivery times. Production needs to grow based on new machinery rather than extra workforce in order to maintain profitability (Saarma 2013).

Although, as the supply is exceeding demand, most producers think that the probability of new companies emerging is rather likely. These are more likely to be small scale niche producers because the required investments are high and finding good sales channels takes time. Thus, most companies are not too worried about competition from emerging producers (Saarma 2013).

## 6 Wooden furniture

### 6.1 Background

Furniture manufacturing has a long history and an important position in the wood processing industry. It is the highest rank in the value adding chain and has maintained a positive trade balance over the last 15 years. 329 million EUR worth of furniture was produced in Estonia in 2010 and 260 million EUR was exported. Majority of the export goes to Europe (EFIA 2011).

This sector employs approximately 11 000 people (EFIA 2011). About half the companies employ 11–50 people and including microbusinesses (1–10 employees) the share is about 75%. Only 3% employ more than 200 people (PW Partners and Sinu Koolituspartner 2009). According to 2011 figures there are 534 furniture producers in Estonia (Pavlov 2013).

Production is, above all, based on subcontracting and supplying European catalogue corporates. Only 10% of export was done individually based on the company's trademark (EFIA 2011).

## 6.2 Raw material

Wooden furniture industry uses mainly solid wood, wood panels, veneer and plywood (EFIA 2011). Favored type of wood is pine, because it's easy to process. Also birch, oak and other species are used. Wooden input material is mostly from Estonia, lesser amount is imported from Finland, Latvia, Poland and Denmark. Plywood is mostly imported from Russia, because supposedly the local supply cannot fulfill the demand. Other non-wood materials are bought from established supply chains throughout Europe (Pavlov 2013).

Domestic wood materials are traded based on global prices. Thus, the furniture manufacturers don't have an input cost advantage, but using local products is still cheaper than importing due to smaller transportation costs. Half of producers find raw material prices good because of long relations with some suppliers or because of large consumption volumes they have a good position for negotiating prices. The other half believes that input materials are expensive. The prices are expected to keep rising in the following years. This can be viewed as a natural process caused by inflation and price incensements in other sectors. Custom taxes and other import regulations don't harm the availability of supply, because relatively small quantities are traded with countries that are affected by this (Pavlov 2013).

Generally, material quality is considered to be good. An important factor for this is maintaining long-lasting good relations with suppliers and thus ensuring reliable delivery times and quality norms. Most companies think it's possible to change the supplier if necessary, but this would generate extra expenses and make delivery times unreliable in the beginning of the process (Pavlov 2013).

Raw material input constitutes to 54% of the end product price on average for Estonian manufacturers. This figure is usually 44–46% for companies in larger countries. Expenses could be decreased by collaborating with neighboring competitors in some procurement activities. Prices are lower for ordering larger volumes and logistics could be optimized. This is one of the main development plans in the Estonian Furniture Industry Associations agenda in order to increase competitiveness in foreign markets by improving collaboration between local manufacturers (EFIA 2011).

## 6.3 Production and export

Total number of furniture producers in 2011 was 534. If we limit the sector to companies with sales turnover more than 600 000 EUR then there are about 170 wood furniture producers, 65 companies use various materials with at least 50% wood input and 50 companies produce soft furniture with 20% wood input. 30 companies produce furniture from metal. 40 companies are at least partially based on foreign capital, 16 of those produce wooden furniture (Pavlov 2013).

Total production of furniture grew from 355 million EUR in 2005 to 394 million EUR in 2011. Wooden furniture production in 2011 was 183 million EUR. Overall volumes decreased by 26% during recession years, but the sector recovered quite quickly. Export generates 60–70% of the sales revenue; companies based on foreign capital are more focused on export (Pavlov 2013).

Domestic consumption in 2009 was 120 million EUR of which 75 million EUR was produced locally. Less than 10% of the population buys more than 80% of the furniture. Consumption is expected to stay at the same level in the following years. Office furniture consumption is about 8–9 million EUR per year, hotels 3.5–4.5 million EUR and the public sector spends about 13 million

EUR on furniture every year. Largest consumers in the public sector are schools, dormitories and other related educational faculties. This is considered a very price sensitive sector (EFIA 2011).

According to a survey by PW Partners and Sinu Koolituspartner (2009), the general difficulty for starting or expanding export was finding partners or sales representatives and marketing products abroad. Of course, the most common obstacle was thought to be the financial crisis but this was not something the manufacturers could control themselves. Also, as most companies are small scale (explained earlier in the background chapter) they have difficulties entering foreign markets with small production volumes and with the financial resources available to them.

2009 was a difficult year for most furniture producers, total export volumes decreased by around 30 million EUR. Trade volumes recovered fast in 2010–2011 exceeding pre-recession years. Figure 11 illustrates the changes of export volumes and price fluctuations of different furniture commodities over the past 10 years. The largest commodity is upholstered wooden frame chairs (about ¼ of material input is wood) worth 89 million EUR in 2012 (Pavlov 2013).

Estonian upholstered wooden chair export had 1% share of the global market in 2011. Important export destinations are Finland (38%), Sweden (32%) and Norway (15%). Export to Sweden decreased by 26% in 2009 but also had the largest growth with 44% in 2010. Estonia has the largest share in Finnish import with 41%, followed by Swedish competitors with two times less volume. Product prices between these two competitors are very similar. Main exporters in Sweden are Poland, Lithuania and China. Estonia competes in the global wooden chair market with middle price producers. Estonian prices are on average two times more expensive than Polish and Chinese products and 30–50% cheaper than Lithuanian, Danish and Italian wooden chairs (Pavlov 2013).

Wooden bedroom furniture grew on average 3% per year during 2007–2011. Global import and price level didn't change during recession years, thus Estonia has managed to stay competitive

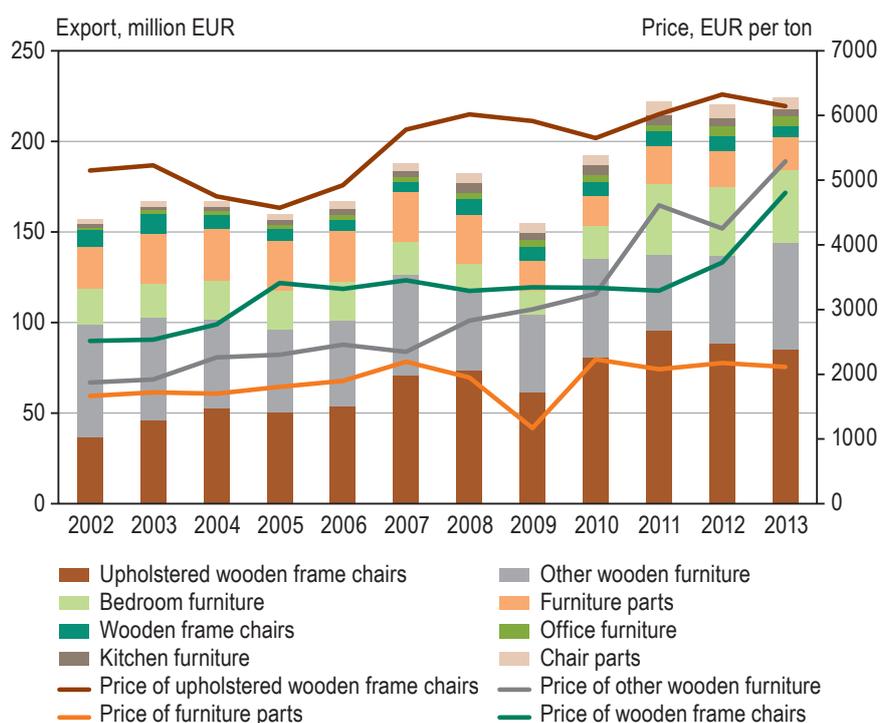


Figure 11. Export of wooden furniture 2002–2013 (Eurostat 2014).

throughout the years. In 2011 bedroom furniture was exported the most to Germany, France, Denmark, Finland and Russia. In 2011 8.5% of Estonian wooden bedroom furniture was exported to Denmark but in 2012 this figure grew to 43%. Now Estonia is the largest exporter to Denmark, followed by Sweden and China with two to three times less volume (Pavlov 2013).

Export of furniture parts has decreased yearly on average by 3%. There was a sudden drop of price and volume in 2009 but it recovered to pre-recession level by the next year (Figure 11). Main export markets are Finland and Sweden. Largest competitor in Finnish market is Sweden, also Germany, Italy and Austria (Pavlov 2013).

Export of other wooden furniture has stayed stable throughout the years. However, unit price has grown on average 11% per year, even during recession years (Figure 11). In 2008 export to Sweden decreased the most (53%). Export volumes recovered in 2010 thanks to increased demand in Russia and Sweden. Main export partners in 2011 were Finland, Denmark and Russia (Pavlov 2013).

Rest of the products, such as wooden kitchen furniture, chair parts, wooden chairs (without padding) and wooden office furniture make only 14% of the Estonian wooden furniture export. Same countries are targeted through sales as mentioned with the previous commodities (Pavlov 2013).

## 6.4 Investments

Most furniture manufacturers are micro companies, who don't have the need and resources for large investments. The same situation is with soft furniture producers who use a small share of wood input. For them it is more reasonable to purchase the materials already cut to required measurements (Pavlov 2013).

Investments grew on average 3 million EUR per year till year 2006. In the economic boom period, investments peaked at 50 million EUR in 2006. This came to a fast stop during recession times as it can be seen in Figure 12. By now the sector has recovered in sales revenue, but at the moment companies are more conservative about further investments than before. Also, most of the larger investments have already been done during the economic boom (Economic Yearbook 2012).

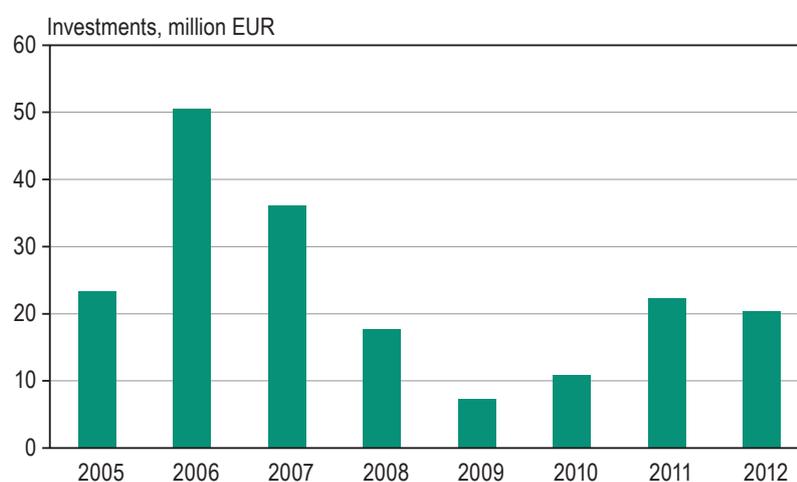


Figure 12. Investments into capital assets 2005–2012 (Statistics Estonia 2014).

Estonian furniture manufacturers made investments on average of 1 400 EUR per employee in 2010. This is two times larger in Finnish companies and three times larger in Swedish companies. Investments per employee were also bigger in Lithuania (2 000 EUR) and Poland (1 900 EUR) (Pavlov 2013).

## **7 Prefabricated wooden houses**

### **7.1 Background**

Handmade log houses have a long history in Estonia, farmhouses have been built from local pine and spruce logs for centuries. Oldest still standing log houses in Estonia date back as much as 300 years. Manufacturing of prefabricated houses from milled logs and panels started developing in 1950s (Eesti Puitmajaliit 2014). In 1991 this sector was considered to be operating industrially (Saarma 2013).

Today, manufacturing of prefabricated wooden houses has grown into a separate sector with 142 operating companies, generating about 245 million EUR sales revenue per year, of which 85–90% is from export (Eesti Puitmajaliit 2014). This sector employs more than 2000 people. Wooden house manufacturing can be considered as a concentrated field, because 16% of companies produce 80% of the sales revenues (Saarma 2013).

### **7.2 Advantages of prefabricated wooden houses**

Producing prefabricated wooden houses in indoor factory conditions makes the production much more efficient and profitable for the company. Depending on the final product, companies can save costs on many different operations. Planing and cutting the wooden details can be almost fully automated if the houses are modeled in special computer software and later fed into modern machinery. Production in general sense can be optimized by creating a production line where each part of the build is done by specialists.

The more complex the building is the more operational costs can be saved by producing in factory conditions, because:

- 1) Availability of all necessary tools and cranes in one place. Logistics of input materials is simplified for the workers and suppliers.
- 2) The process is easy to supervise and to make quality controls. Manufacturing processes are fast and effective, different operations can be divided between specialized workers. Working conditions are safer and healthier for the workers.
- 3) Modular houses consist of separate modules. These modules can be pre-fitted with electronic wiring, plumbing and even decorated during the manufacturing process inside the factory.
- 4) Weather does not affect the process inside factories. Assembly of prefabricated houses on construction site takes little time and thus negative effects of bad weather are minimized.
- 5) Overall price of the product is reduced thanks to ergonomic manufacturing process and simplified logistics. Prefabricated houses present the opportunity to construct buildings in countries with lower costs and export the product to another country.

Wood is a renewable building material that is produced locally. Preferring wooden construction in public procurement is more beneficial for the government because most the taxes from the production chain of wood are paid inside the country. Prefabricated wooden house factories are often located outside of large cities and are an important source of employment in some rural areas.

### 7.3 Raw Material

Wooden materials used in construction can be classified as such: sawn timber, planed wood (exterior and interior wall paneling, flooring, etc.), impregnated wood, panels (plywood, particle board and fiberboard), beams, windows and doors (Riistop 2003). Input materials are mainly bought from local producers, however there is no price advantage compared to importing. Some amount is imported to get cheaper prices, spread risks, improve competition between suppliers and mainly because local suppliers don't always have necessary quantities of some required dimensions (Saarma 2013).

Companies are satisfied with the wood quality, but the general opinion is that raw materials are considered too expensive. Operating in a highly forested country doesn't create price advantages for local consumers because sawmills and other producers can export their products if global demand rises the prices in other regions (Saarma 2013).

Most used tree species are spruce, pine and larch. Larch is still less commonly used but it suits well in exterior use, because it is very resistant to decay. Spruce is better for exterior wall paneling as it absorbs less water and holds color better. However, due to its molecular structure, spruce lumber cannot be impregnated (absorbs very little). Thus, pine is used for this purpose. Impregnated wood is used for terraces, exterior railings, lower parts of the framework and all parts that come in contact with soil. Impregnated wood is sold as both sawn and planed (Riistop 2003).

Most used sawn wood dimensions are 19×100 (pine), 22×100 (spruce), 50×50, 50×100, 50×150 and 50×200. Lumber with 50 mm width is often achieved from sawing a 100 mm piece into two, thus the real dimensions might be 48 mm. Common lengths are 1.8...5.4 (6.0) m with 0.3 m steps. Usage of planed wood in construction is becoming more common because of its conveniently accurate dimensions. According to national regulations, lumber used in framework has to be strength graded. Conventional grading is not connected with strength grading. For strength graded beams the position of knots is more important than the number and size of knots. Strength grading is done visually or mechanically and all sorted beams get a certification stamp (C16 or C 24) (Riistop 2003).

Doors and windows are the second most important input materials. Companies usually have one or few partners who supply all the doors and windows. Price and quality is considered good from Estonian suppliers, but also imported products are used if the customer requests this. For example, this is often requested from Norwegian customers, as they prefer their local products due to better insulation quality. Other construction materials are mostly purchased from Estonian resellers (Saarma 2013).

### 7.4 Production and export

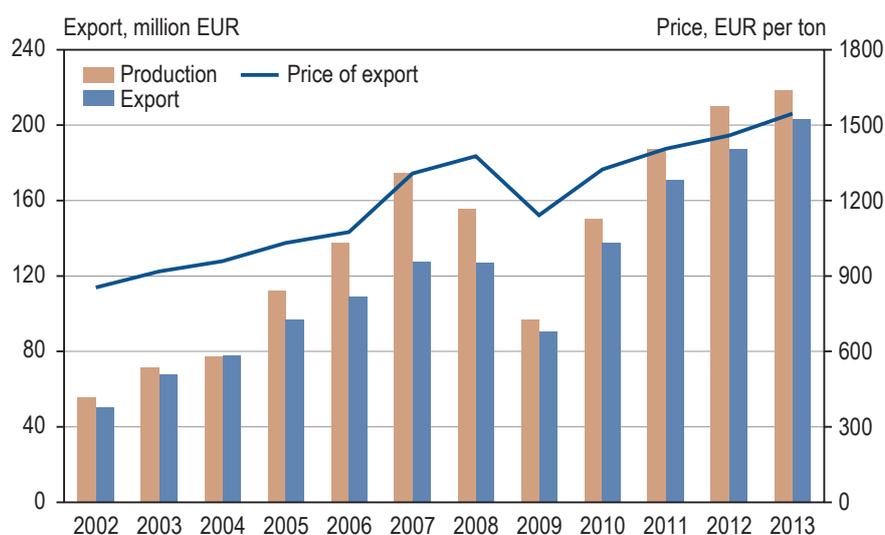
Production of prefabricated wooden houses is one of the most successful industries in the wood processing sector. In 2013 Estonia was the largest exporter of prefabricated wooden houses in

Europe. Export grew from 189.5 million EUR in 2012 to 202.4 million EUR in 2013 or 8%. However, in total sales revenue, Estonia is currently in eighth position in Europe. Germany produced 1.7 billion EUR of wooden houses in 2013, but 90% of their sales are made in the domestic market. Estonia, on the other hand, exports about 90% of its wooden house production (Wildbuild 2014).

Surviving recession years was difficult for most companies and those that were before operating inefficiently disappeared. On the other hand, this was refreshing for the industry. Negative aspects of the building boom (fluctuating quality, unqualified workers and inefficiency) were reduced thanks to required changes (Saarma 2013). Export sales recovered fast and more than doubled in three years. The significance of export can be seen throughout the years (Figure 13).

Prefabricated wooden house production is a concentrated sector. There are 142 active companies and the five largest companies shown in Table 6 generate more than 50% of all sales revenue.

Majority of export goes to eight European countries and half of it goes to Norway and Germany. Other important destinations are France, Sweden, Finland, Denmark and UK. Few companies also market their products out of Europe, but the general tendency is to focus on one or two countries (Saarma 2013).



**Figure 13.** Production and export of prefabricated wooden houses 2002–2013 (Eurostat 2014, Statistics Estonia 2014).

**Table 6.** Annual sales revenues of largest prefabricated wooden house producers (Kodumaja 2014, Ehitusuudised 2014, Palmako 2014, Lasita Maja 2014).

Company	Sales revenue 2013
Kodumaja	53 million EUR
Palmako	25,7 million EUR
Harmet	22 million EUR
Lasita Maja	17.5 million EUR
Matek*	-

\* Company has not made this information public

Estonia has 25% share from total import in Norway and 7.5% in Germany. The largest supplier in Norwegian market is Sweden. Sweden sells their prefabricated wooden houses in Norway on average for 3 600 EUR per ton, but Estonia for 2 700 EUR per ton. Estonian producers are on the same price level with Latvia, Lithuania, Poland and China. In Germany the biggest competitors are Czech Republic, Poland, Austria and Holland. Price differences are similar to the situation in Norway. Estonian companies sell for on average 1 900 EUR per ton, Czech for 2 500 EUR and some countries even for 4 000 EUR per ton (Saarma 2013).

One factor affecting the price difference is that Estonian companies sell to middlemen, not directly to the end customer. Most companies don't intend to change this and plan to keep on expanding with the same method. Also the complexity of the final product determines the price. Some Estonian companies sell houses with internal finishes, kitchen furniture, sauna and heating. This is very difficult, because it requires a vast assortment of selectable options and knowledge of customer preferences in different markets (Saarma 2013).

## **7.5 Product assortments**

Information from the Estonian Woodhouse Association (EWA) tells that there are 34 prefabricated wooden house producers. Most of the largest and most important companies have joined the association, except AS Kodumaja. Purpose of this association is to improve competitiveness and marketing of its members through different cooperation and partnerships. EWA is a member of International Logbuilders' Association since 2008 (Eesti Puitmajaliit 2014). Companies listed in the following chapters are based on the EWA members list.

### **7.5.1 Garden houses**

Garden house walls are typically made from 20–70 mm planed beams. Thickness of the walls depends on the purpose of the house. Up to 28 mm is fine for storing garden tools and 40–70 mm is recommended for summer cottages or grill houses. Prefabricated garden houses come in a compact package with all the necessary parts and details: impregnated foundation beams, floor and sealing boards, spliced wall beams, doors and windows, assembly products and also roof cover if the customer requests it (Eesti Puitmajaliit 2014).

Garden houses producers are Akso-Haus, Aru Grupp, Palmako, Ritsu, RPM Grupp, Tene Kaubandus, Tenon Holding and Timbeco Woodhouse.

### **7.5.2 Machined log houses**

Machined log houses are produced in factories through mechanized processing. Logs are planed and crosscut to required dimensions and tenons are cut with machinery precision. Natural or glulam logs can be planed to round, oval or faceted profiles (Eesti Puitmajaliit 2014).

Estonian producers have a wide variety of catalogue ready-made projects, but the technology also allows manufacturing houses with custom design and dimensions to meet the customer's or architect's ideas. For example, special splicer corner design for urban environment or homes with double walls and extra insulation (Eesti Puitmajaliit 2014).

Machined log home producers are Aru Grupp, Finnlamelli Eesti, Mountain Loghome, Lalmako, Palmatin, Rakvere Metsamajand, Ritsu, RPM Grupp, Tene Kaubandus, Tenon Holding and Timbeco Woodhouse.

### **7.5.3 Handcrafted log houses**

Handcrafted log houses are produced from pre-dried logs in indoor factory conditions. This ensures high quality finishing and more efficient working conditions. Handcrafting is very ecofriendly; it creates less waste because less material is removed from the logs. Thus, the walls are thicker and every house is unique as every log is processed individually and the end result has a more natural appearance. The logs can be either round or cut square (Eesti Puitmajaliit 2014).

Producers are A&H Ristpalkmajad, ELH Palkehituse, Estnor, GG-Group, Hobbiton Home, Majand, Palkehituse, Tender Ehitus and Vipson Projekt.

### **7.5.4 Prefabricated elements**

Manufacturing of prefabricated elements (closed panel timber frames) is an efficient way of producing an energy efficient and high quality house. The house is divided into elements: façade and external walls, roof panels, floor elements, internal wall elements, ceiling elements, terrace and balcony elements. These consist of a timber frame filled with insulation and covered from both sides (Eesti Puitmajaliit 2014).

Splitting the house into separate elements simplifies production and transportation. The elements are then assembled together at construction site with some additional fabrication (Eesti Puitmajaliit 2014).

Producers are Akso-Haus, Aru Grupp, Estnor, Greco Engineering, Harmet, Komforthus, Matek, Nordic Houses, Nurban, Q-haus Baltic, Ritsu, RPM Grupp, Seve Ehituse and Timbeco Woodhouse.

### **7.5.5 Modular houses**

Prefabricated module is a spatial part of the building, where the walls, floor and ceiling are joined and finished in the factory. This spatial element can consist of several small rooms. The high quality of the homes and the efficiency of the production process are ensured by controlled factory-environment, strict production rules and trained specialists producing the houses. Since a prefabricated module is a closed element, it is possible to complete almost 95% of the interior design and utilities already inside the factory (Eesti Puitmajaliit 2014).

Modules are transported to construction site, where assembly takes minimal time due to high level of pre-work. This minimized construction costs in countries with expensive labor and material costs as the work can be done in the prefabrication country. Using prefabricated modules also allows building multistory apartment buildings that are of high quality and energy efficient (Eesti Puitmajaliit 2014).

Wooden modules can be used also multistory buildings if engineered in the right way. Estonian company Kodumaja signed a contract with BOB Eiendomsutvikling AS to build a 14-storey high timber building in Bergen, Norway. This would be the tallest building of its kind in the world (Kodumaja 2014).

Producers of prefabricated modules include Akso-Haus, Matek, Nurban, Q-haus Baltic, Ritsu, RPM Grupp, Seve Ehituse and Kodumaja.

## 7.6 Investments

Companies use about 65% of their current production capacity. This is due to fluctuating demand – production reaches maximum levels during high season and slows down at winter. Increasing expenses on raw materials and salaries push woodhouse producers to invest in further mechanization. However, everything can't be mechanized and some processes are done better by hand. High share of handicraft is the reason why added value per worker is one of the lowest in the wood processing sector (Saarma 2013).

Another motivator for investments is increased demand from successful business partners. Wooden house manufacturer Matek established a new additional factory that doubled the company's potential production capacity. Cost of the project was about 3.5 million EUR. Handcrafted loghouse and prefabricated home producer EstNor invested 0.9 million EUR in a new production building. Timbeco Woodhouse expanded warehouse capacity and established a new production building by investing 40 thousand EUR and 250 thousand EUR in 2013 (Reimer 2013).

## 7.7 EU policies affecting wood construction

In Europe, construction is indisputably the largest consumer of raw materials. Measured by weight, construction consumes 33–50% of all raw materials and construction and deconstruction produce approximately 40–50% of all waste (Julin 2010). New construction accounts for 66% of building activities in Eastern Europe and 33% in Western European countries (UNECE 2014).

Using wood in construction is beneficial for the environment because of carbon sequestration and replacing mining based energy-intensive materials with sustainably produced wood products. Europe can meet 25% of the Kyoto target by increasing the market share of wood construction by 10%. Increasing the usage of wood in Europe by 4% annually would generate an annual reduction of approximately 150 million tons in carbon dioxide emissions, worth approximately 1.8 billion EUR in emissions trading (Julin 2010).

There are several policies that support the idea of using greener construction materials, but none of them set clear actions to increase the consumption of wood-based construction materials.

The European Construction Products Regulation came into force in the European Union in July 2013. The regulation introduced legal requirement for the sustainable use of natural resources in the European Union building sector. In particular it requires the recyclability of materials and parts after demolition, durability and the use of environmentally compatible raw and secondary materials (UNECE 2014).

The ECO Platform was also launched in September 2013 as an EU initiative to improve sustainability in the construction products industry. One of the objectives of ECO Platform is to develop a system of verified environmental information of construction products, in particular type III declarations called Environmental Product Declarations (EPD) (ECO Platform 2014). The ECO Platform aims to harmonize the new EU Construction Product Directive and standard

EN 15804. The harmonized standard applies to the end use of Life Cycle Analysis, preparation of EPDs and provides a common framework for implementation throughout the EU. In practice, it is the responsibility of EU members to introduce regulations and programmes to ensure that these requirements are met. By May 2014 Netherlands, France, Germany and the United Kingdom have introduced specific measures (UNECE 2014).

Despite all the strategies and initiatives, in practice the promotion of wood based construction materials is a controversial task within EU regulations. According to the Commission, certain construction materials or methods cannot be favored in order to ensure a functioning market. EU promotes freedom of movement for all construction products within the internal market. Then again, the general understanding is that environmental issues should have more impact on decision making, and products should also compete based on their environmental characteristics (Julin 2010).

## 8 Conclusions

The purpose of this study was to give overviews of different mechanical wood processing sectors in Estonia. Most of the industries collaborate in supply chains or compete with each other for raw materials or customers. One way or the other, the sector as a whole is interconnected and affected by similar global and domestic trends. The development and competitiveness of this sector is very important to the Estonian economy. Timber processing, pulp and paper and furniture production constitute to more than 20% of the manufacturing industry. Wood and wood products constituted to 7.7% of the whole export value in 2011.

Clear advantage for the wood processing industry is abundance of forest resources. A bit more than half of the land is covered by forests and with developed forest management traditions the supply can continue to be sustainable. However, due to loss of roundwood import from Russia since 2007 Estonian roundwood consumers have had to improve domestic procurement or reduce production quantities.

Recent global financial crisis hit the wood processing industry hard in 2008 and 2009. By 2009 export of wood products had decreased by 30% while the overall Estonian export had decreased only by 15%. Despite the sudden drop in sales, Estonian wood processing companies managed to survive the crisis well by reestablishing export markets, changing organizational structures and improving productivity. Less sufficient or flexible companies disappeared and this made the sector more sufficient and globally competitive. By now sales figures have surpassed the pre-recession level.

Another advantage for Estonia is its geographical location. Estonia cannot increase the harvesting volumes substantially due to the proportion of inactive private forest owners. However, being located next to countries with similar or lower cost level like the Baltic States and NW Russia, import of raw materials can be increased. Nordic countries are a good export destination as they are logistically close and have relatively good purchasing power. Export can still be improved in this area by marketing brand names and increasing product values.

Many producers have managed to improve their position in export markets despite the economic crisis and decrease in demand. For example, Estonia is currently one of the largest exporters of wooden doors and prefabricated wooden houses in Europe. However, compared to Sweden and Finland, most Estonian wood processing industries still have lower productivity and less investments. Sawn and planed wood producers have managed to raise the export prices to a similar level of Sweden and Finland. However, rest of the post-processing industries are exporting products for similar prices as Latvia and Lithuania but on a lower price level than the Nordic competitors.

Innovations and investments are key factors for keeping this industry competitive. Although the sector is densely inhabited, there is still room for smaller production units to improve their output efficiency or to shift the focus on some niche products. Export should grow rather from end products by increasing product quality and unit price to the same level as the market leaders. Domestic consumption could be improved when wooden materials start to be preferred in public and private construction procurement. Wood is locally produced and processed and throughout the production chain majority of the taxes are paid domestically. Also the country will benefit from emissions trading by increasing CO<sub>2</sub> sequestration.

Estonian wood processing industries have grown and developed tremendously over the last decade. Sales and added value have almost doubled in the last ten years. The fact that Estonia is always comparing its forest and wood processing activities to the Nordic countries that are globally in the leading position shows a lot of ambition and intention to develop.

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