

Interim Report

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The Future of the European Solid Wood Industry

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Abstract

This paper was presented as a keynote address at the Second International Wood Markets Conference in October 2000 in Melbourne, Australia. The conference brought together forest sector industrialists and policymakers from Oceania, Asia, South and North America. The paper is an extension of two earlier papers presented at the First International Wood Markets Conference held in 1999 in Auckland, New Zealand.

The present paper examines the possible dramatic change that the European solid wood industry has to go through in order to be competitive. The traditional markets for solid wood products are saturated and future markets are in China, the rest of Asia and Africa. The industry is expected to go through dramatic changes in Europe resulting in a much more concentrated industry in the form of larger enterprises and mills.

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The Future of the European Solid Wood Industry

Sten Nilsson

1. Introduction

The solid wood industry (wood-based industry excluding pulp and paper and associated industries) are going through rather dramatic changes worldwide. The objective of this paper is to discuss those changes from the European perspective and provide an outlook for this industry in Europe to the year 2010.

2. Demand

Future demand is one of the most powerful factors for structural change of the industry. In illustrating future demand development I will use two independent studies: Timwood (1998) and WRI (1999).

WRI (1999) has made demand forecasts covering the period 1997–2030 but in this case the forecasts for the period 1997–2010 are summarized in Table 1.

Table 1: Global demand forecasts for 1997–2010 for solid wood products in million m³. After WRI (1999).

	1997	2010	Increase	%/Year
Coniferous Sawnwood	268.7	311.5	42.8	1.14
Non-Coniferous Sawnwood	122.4	147.0	24.6	1.42
Coniferous Plywood	27.6	31.3	3.7	0.96
Non-Coniferous Plywood	30.9	40.3	9.4	2.23
Oriented Strand Board	15.6	23.4	7.8	3.17
Particleboard	57.4	71.4	14.0	1.69
Medium Density Fiberboard	14.4	20.9	6.5	2.91
Other Fiberboard	10.9	12.8	1.9	1.27

The forecasted demand changes are rather bleak except for Oriented Strand Board (OSB), Medium Density Fiberboard (MDF) and Non-Coniferous Plywood. With respect to coniferous sawnwood the demand forecasts for the traditional markets are very weak. The substantial growth is expected to take place in Eastern Europe, Russia, Asia and China and corresponds to some 70% of total global estimated increase in consumption.

The picture is the same for non-coniferous sawnwood, with these regions (Eastern Europe, Russia, Asia, and China) assumed to be responsible for 80% of the increased consumption to the year 2010. The dominating regions with respect to increased consumption of coniferous plywood are Eastern Europe, Russia, China and Western Europe. The dominating regions with respect to increased non-coniferous plywood consumption are Russia, Eastern Europe, China and Asia. The expected booming markets for OSB are in Western Europe, Japan, Asia, and Eastern Europe. The future increase in particleboard consumption is dominated by Russia, China, Eastern Europe and Asia. The future increase in MDF markets are Western Europe, China, Asia and USA. Other fiberboard consumption is rather modest and will not have any major structural impact.

What do we learn from this picture? The following observations can be made:

- The market development will not be a driving force for the development of the sawmilling industry. Competition will increase. The interesting markets are Eastern Europe, Russia, Asia and China. Strong structural changes of the sawmilling industry can be expected.
- With respect to plywood, non-coniferous plywood shows a substantial market growth dominated by Eastern Europe, Russia, China and Asia which can trigger structural change in the industry. The coniferous plywood market shows an overall weak development which means increased competition and stable or declining prices, but there are strong positive market developments in the aforementioned regions and in Western Europe. Structural changes can be expected.
- The OSB market shows a strong development which can be a driving force for development of the industry. The interesting markets from a volume point of view are the USA, Western Europe and Japan.
- The MDF market development is nearly as strong as for the OSB market and can serve as an incentive for development of the industry. The interesting markets from a volume point of view are Western Europe, Japan, China, Asia, the USA and Eastern Europe.
- Particleboard and other fiberboards show a weak to moderate market development with China, Eastern Europe, Asia, Russia and, to some extent, Western Europe as the interesting regions from a volume point of view. Structural changes can be expected in the industry.

Timwood (1998) followed a somewhat different approach by assessing the regional supply and demand balances for solid wood products. The results are summarized in Table 2.

Table 2: Supply and demand balances for solid wood products in 2010 expressed in million m³ and percentage (+ surplus, – deficit). After Timwood (1998).

	Sawnwood		Plywood		Particleboard ^a		Fiberboard ^b	
	m ³	% ^c	m ³	%	m ³	%	m ³	%
Europe	+2.0	+2	-0.9	-11	+1.2	+3	+0.7	+10
Oceania	+3	+50	+0.12	+20	+0.2	+15	+0.4	+80
South America	+6.0	+21	+1.90	+136	+0.2	+9	+0.5	+42
North and Central America	+28.0	+17	-0.2	-1	0	0	+0.2	+2
Africa	-1.0	-8	-0.1	-7	-0.05	-8	-0.05	-6
CIS Countries	+5.0	+14	+0.9	+82	-0.1	-2	+0.2	+13
Asia	-19.5	-16	-1.4	-4	-1.2	-11	-1.7	-18
Total	+23.5		+0.32		+0.25		+0.28	

^a Including OSB.

^b Including MDF.

^c Balance volume as percentage of demanded volume.

There are similarities in the results achieved by this approach and the WRI (1999) demand estimates. The observations according to Table 2 are the following:

- Sawnwood
 - structural changes are expected due to overcapacity (23.5 million m³) and no price improvements.
 - the market opportunities are Asia and Africa but competition will increase due to the fact that all other regions will try to export to these two regions.
 - the only way to improve the overall market conditions for sawnwood seems to be through actions improving the consumption level of sawnwood in developed markets.
- Plywood
 - an oversupply of 0.32 million m³ of plywood is assessed.
 - the huge deficit market is Asia and to some extent North America, in the latter case due to the substitution process by OSB, which will close down plywood capacities.
 - Europe will increase production and thereby decrease its current import. There is an expected substitution of plywood by OSB.
- Particleboard
 - the key target market for the producing regions will be Asia.
 - Europe will be the largest producer in the world with substantial overcapacity, which will drive structural changes.

- Fiberboard
 - the key target market for the production regions will be Asia.
 - Europe will have a substantial overcapacity, which will foster structural changes.
 - production in Europe will nearly double, mainly caused by increased MDF production.

Trømborg *et al.* (2000) used dynamic partial equilibrium modeling in order to assess the global timber market in 2010 due to changes in economic growth, timber supply and technological trends. In their analysis they only identify the solid wood production group “Sawnwood and Plywood”. The supply and demand balance for this group in 2010 shows a substantially higher surplus for Europe compared to the Timwood (1998) study, 7.8 million m³ instead of 2.0 million m³. On the other hand the total global surplus is substantially lower +2.9 million m³. This study also identifies Asia (-22.8 million m³) and Africa (-5.3 million m³) as the major future deficit regions.

From the above studies it is obvious that market development (volumes) will only “pull” the industrial development of the OSB and MDF industry in the traditional markets. For the other solid wood products the interesting future markets are Asia and Africa, meaning that intensified competition can be expected in these markets from other producing regions.

Based on the above studies, with respect to Europe, the following conclusions can be singled out for 2010:

- Surplus of sawnwood;
- Structural changes to be expected in the sawmilling industry;
- Increased plywood production for domestic use;
- Europe will be the largest particleboard producer with substantial regional overcapacity; and
- Europe will have regional overcapacity for the production of traditional fiberboard.

3. Price Development

A positive price development for solid wood products could act as a driving force for the development of the solid wood products industry. Solid wood products are global commodities. Therefore, price developments can be studied by global equilibrium models. FAO (1997) has assessed the real world prices for solid wood products in 2010 and these are presented in Table 3. Trømborg *et al.* (2000) show similar price developments.

Table 3: Real world prices of solid wood products in 2010 (1994 US\$). After FAO (1997).

Price level in 2010	
Sawnwood	Price level of 1994
Plywood	Slightly above 1994 price level
Particleboard	Slightly above 1994 price level
Fiberboard	Price level of 1994

It is obvious that this kind of price development is an indication of a Stalemate Phase (Mensch, 1979) in the solid wood industry which is a signal for structural change. The exceptions for the Stalemate Phase are the OSB and MDF industries, which seem to be in an Establishment Phase.

4. European Wood Balance

Both Timwood (1998) and Trømborg *et al.* (2000) expect a dramatic growth in European sawnwood production between 1997 and 2010. The increase is assessed to be in the range of 11–20 million m³ due to increased availability of sawlogs.

Since 1990 there is a downward trend in the fellings in Europe (30 countries). In 1990 the fellings were 474 million m³ o.b. and in 1997 dropped to 417 million m³ o.b., but only about 65% of the growth is harvested.

Nabuurs *et al.* (2000) kindly made available for this paper the latest (not yet published) analyses on wood supply possibilities in Europe in the form of fellings. The authors have produced a number of different scenarios. It is difficult to assess how supply will look in the future due to the impact of many interlinked factors. Therefore in this case I will use the two extremes of a multi-functional scenario reflecting changed perceptions of forestry and a scenario on the maximum sustainable production level. In assessing the rate of removals and extent of sawlogs the conversion factors used by Pajuojä (1995) have been employed. The statistics for 1997 and the conversion factors for sawlogs to sawnwood are taken from FAO (1999) and UN (1998a, b).

In Table 4 I have tried to calculate the supply possibilities of sawlogs and the corresponding possible sawnwood production in 2010 based on the two scenarios mentioned earlier. For a comparison the values for 1997 are also presented. The assessment deals with European countries (except Belarus, Moldova, European Russia and Ukraine). The sawnwood production estimates are based on the domestic wood production in the European region and do not take into account any imported sawlogs to the region. The removal scenarios are adjusted to also include other wooded land.

Table 4: Possible removals and possible sawnwood production in 2010 in million m³ in Europe.

	Removals on exploitable forest and other wooded lands million m ³ u.b.	Sawlogs million m ³ u.b.		Sawnwood production in million m ³	
		Coniferous	Non- Coniferous	Coniferous	Non- Coniferous
1997	373	155	33	83	11.5
Total, 1997					93.5
2010	424–598	176–249	38–53	93–132	13–19
Total, 2010 lower scenario					106

According to the lower scenario there would be a possibility to increase the total sawnwood production between 1997 and 2010 by about 13 million m³ resulting in a total production of 106 million m³. This is very well in line with the Timwood (1998) estimate. Trømborg *et al.* (2000) estimate a total plywood and sawnwood production for Europe of 112 million m³ in 2010 if the imported logs are discounted in the production. If the average of the two scenarios (high and low wood supply) is used, the possibility to increase sawnwood production is 38 million m³. Stora Enso (SHIV/ASIB, 2000) assumes a net export of coniferous lumber from Western Europe of 10 million m³ by 2010. This increased export is to some extent based on increased import of sawlogs. At the same time, Stora Enso expects a decline of the export from North America of 10 million m³ by 2010.

So far we have excluded Belarus, Moldova, European Russia and Ukraine from the picture. There is a high probability that during the scenario period these countries will increase their exports of logs to the rest of Europe, or increase the domestic production of sawnwood, or foreign industry will invest in new capacities, or a combination of these measures will take place. This can be illustrated by the current trade of wood raw material in the Baltic Sea region (Figure 1).

All of this will increase the sawnwood production in Europe. In order to estimate the possible supply from these regions the following sources were used. For European Russia I have used analyses by FAO (1999), Nilsson and Shvidenko (1998) and Nilsson (1999a); for Belarus by Scandiaconsult (1997) and Nilsson (1999b); and for Ukraine, Nilsson and Shvidenko (1999), Nilsson (1999b) and Järvholm (1999). The assessment is summarized in Table 5.



Figure 1: The Baltic Sea region. An integrated wood market.

Table 5: Assessment of removals and sawnwood production in European Russia, Belarus and Ukraine in million m³.

	Removals on exploitable forests & other wooded land in million m ³ u.b.	Sawlogs million m ³		Sawnwood production in million m ³	
		Coniferous	Non- Coniferous	Coniferous	Non- Coniferous
1997					
• European Russia	70.0 ^a	23.3 ^a	8.3 ^a	13.0	3.2
• Belarus	17.6 ^b	8.1 ^b	2.9 ^b	0.9	0.6
• Ukraine	10.1	3.3	2.9	0.35	0.3
Total	97.7	34.7	14.1	14.25	4.1
2010					
• European Russia	120 ^c –180 ^d	40–60	14–22	20–30	4.5–7.0
• Belarus		6.0	3.9	3.0	2.1
• Ukraine		4.4	2.5	2.2	0.8
Total		50.4–70.4	20.4–28.4	25.2–35.2	7.4–9.9

^a Including so-called unofficial harvests.

^b Official statistics but not realistic.

^c Probable harvest.

^d Sustainable harvest.

From Table 5 it can be seen that in the lower scenario there is a possibility to increase sawnwood production in total of 14 million m³ (11 million m³ of coniferous and 3 million m³ of non-coniferous) between 1997 and 2010. In the higher scenario the total potential for an increase of sawnwood production is 22 million m³ (16 million m³ coniferous and 6.0 million m³ of non-coniferous) between 1997 and 2010. If we combine the lower scenarios from Tables 4 and 5 we get a total picture according to Table 6.

Table 6: Assessed possible sawnwood production based on domestic log production in 2010 from Pan Europe in million m³.

	Sawnwood production in million m ³	
	Coniferous	Non-Coniferous
1997	96.3	15.6
2010	118.2	20.4
Increase between 1997 and 2010	21.9	4.8

The lower scenario indicates a possibility of increased coniferous sawnwood of 22 million m³ and for non-coniferous sawnwood 5 million m³. The high wood supply scenario indicates a potential of increased total lumber production of 78 million m³ by 2010.

The wood supply analysis until 2050, not discussed here, shows a continued increase in the supply after 2010. This means that in the longer term sawnwood production can increase even further from the region.

Wood supply analysis also shows that there are, from a wood supply point of view, good possibilities to increase the production substantially for the other solid wood products in the Pan European region.

5. Structural Change of the European Solid Wood Industry

In the following discussion I will concentrate the presentation on the sawmilling industry. However, the illustration is also valid for the other traditional solid wood product sectors (with the exception of OSB and MDF).

New requirements from the business environment of the sawmilling industry demand substantial structural changes in order to achieve competitiveness and acceptable profitability. Examples on the focus for structural changes are:

- internationalization of trade;
- increased quality requirements on final products; and
- changed customer and trading structures (e.g., e-business).

The solid wood industry will be affected by a number of driving forces stemming from their customers and the customers' customers. The Swedish Forestry Association (2000) has illustrated this market chain in Table 7.

Table 7: Summary of drivers and causation in the wood products industry. After The Swedish Forestry Association (2000).

Customer's customer e.g., "Mr. Smith"	Customer e.g., Furniture producer, Builder, DIY	Wood products industry e.g., sawmill, plywood plant, etc.
<i>Exerts pressure →</i>	<i>Exerts pressure →</i>	<i>Recipient →</i>
Driver	Driver	Expected change
<ul style="list-style-type: none"> • More for less • Greater choices • Product reliability • Information society 	<ul style="list-style-type: none"> • Economies of scale leading to industry consolidation • Reduce costly inventories • More direct contacts 	<ul style="list-style-type: none"> • Consolidation, fewer and bigger producers to match customers' development • Service demands increase, most notably JIT, shorter lead-time • Partnering, long-term relations • Less business through middlemen • Increased interest for Basket of wood products
	<ul style="list-style-type: none"> • Limited availability of carpenters/manual labor 	<ul style="list-style-type: none"> • Higher share of blanks, components, prefab elements, systems
	<ul style="list-style-type: none"> • Higher demand on product performance • More stringent building codes 	<ul style="list-style-type: none"> • Demands for longer warranty
	<ul style="list-style-type: none"> • Increased availability of alternative materials/Substitution • Neutral raw material selection 	<ul style="list-style-type: none"> • Product development • Higher consistency of quality, service, price
	<ul style="list-style-type: none"> • Information availability • E-commerce for raw materials and finished products 	<ul style="list-style-type: none"> • Facilitate e-exchange of information, products and service

To meet the changing demands, customized products and deliveries are required. In meeting the internationalization changed products, intensive marketing and efficient distribution are required. Changed end-use conditions require improved research and development. To create the possibilities to meet the changed demands and cheaper products an important ingredient is the concentration of the industry and large scale operations. Large sized and concentrated industries give a solid financial position, endurance, skilled personnel resources, attractive product mix, strong market organizations, etc.

The Swedish Forestry Association (2000) concludes in its analysis that "wood products manufacturers who comfortably rest on old merits in terms of product and service will not be around for the next decade".

5.1 Concentration of the Industry

Throughout Europe, a concentration of the industry occurs with fewer mills but with higher total production. This is illustrated in Table 8 for a number of countries in Europe based on so-called sawmill inventories. Unfortunately, the inventories have different dates but the development is clear: fewer and bigger mills with higher total production. It should also be pointed out that in most cases the sawmill inventories report higher production compared to the officially reported production figures for the actual year and that the technical capacities of the existing sawmills are substantially higher than the reported production figures.

A representative illustration of the concentration trend is the development in Austria (Figure 2). In the cases with outlooks (Table 8), the process towards bigger and fewer mills is assumed to go even faster in the future. In Germany for example, it is expected that the closing down of mills will result in new establishments of large mills in CIS-countries and Eastern Europe.

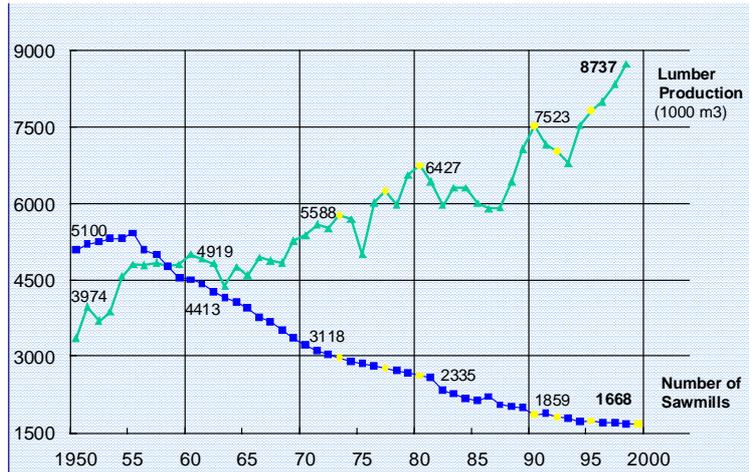


Figure 2: Number of sawmills and production over time in Austria. After Fachverband der Holzindustrie Österreichs (2000).

Table 8: Development of number of sawmills and production with outlook for some European countries.

Switzerland	1991		1996		2010	
	Mills	Production	Mills	Production	Mills	
	7165	1.73 million m ^{3a}	538	1.43 million m ³	320	
France	1980		1994			
	Mills	Production	Mills	Production		
	5241	8.96 million m ³	3337	9.69 million m ³		
Germany	1950	1995		2000	2010 ^b	2020 ^b
	Mills	Mills	Production	Mills	Mills	Mills
	10200	4129	18.0 million m ³	2300	1500	500
Austria	1980		1999			
	Mills	Production	Mills	Production		
	2335	6.43 million m ³	1668	8.74 million m ³		

^a Severe windfalls this year.

^b German mills will be established in CIS-countries and Eastern Europe instead.

In Austria a possible development within the time horizon of 2010 is illustrated in Figure 3 based on discussions with Austrian sawmilling experts.

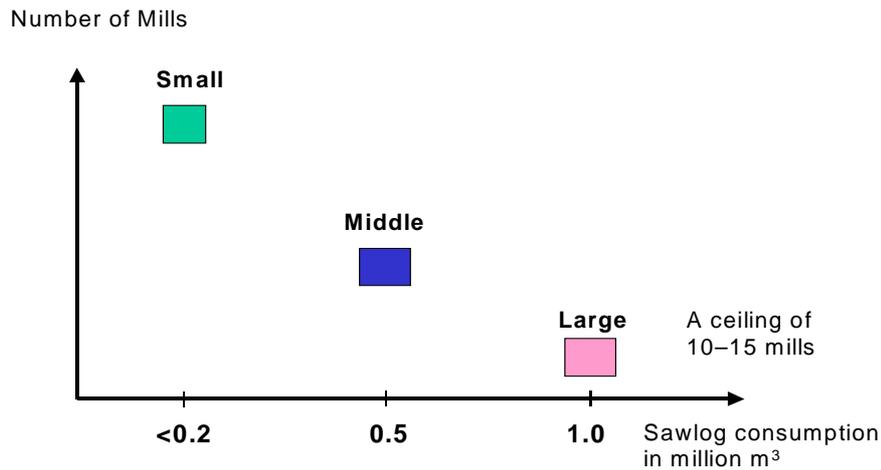


Figure 3: Possible outlook for the sawmilling industry in Austria by 2010.

According to this outlook there will be three major groups of mills, but the total capacity will be dominated by the production of 10–15 mills in the large group. There is a ceiling for the number of large mills (10–15) in Austria due to available sites, wood procurement, storage, transportation, etc. Similar arguments are presented in Germany and Switzerland (SHIV/ASIB, 2000).

In the Austrian case it is assumed that 6–7 mills will move from the middle group to the large group within the time frame of 2010. It is argued that it is easier for the middle group to move to the larger group compared to the small group moving to the middle group. The middle group has the resources needed for a transition but the smaller group has not. The Austrian picture is confirmed in Germany where it is argued that sawmills having a sawlog consumption of less than 0.7 million m³ will disappear in the future.

The Swedish sawmilling industry today produces 15 million m³ of sawnwood. Production has increased by 40% since 1995. Some 250 mills contribute to 98% of the production. The outlook for the sector encompasses two sawmilling enterprises within the pulp and paper industry, one sawmilling enterprise within the forest owner's association, and five groups of enterprises of independent sawmills. These enterprises will have about 70% of the total production. The rest of the sawmills will deal with local and niche markets (Skog and Såg, 1999).

5.2 Mergers

Part of the picture described in Section 5.1 is an effect of mergers. During recent years a number of large sawmilling enterprises have seen the light through mergers in order to meet the requirements from a changed business environment and internationalization. The most visible example is Stora Enso, which is a merger between Enso of Finland, Schweighofer of Austria, and Stora of Sweden with production in Finland, Sweden, Austria and the Czech Republic. In Table 9, the 25 largest coniferous sawnwood enterprises in 1998 with changes in 1999 are presented.

It can be concluded that there have been rather dramatic changes in just a year towards larger enterprises through mergers in the top league of the European coniferous sawnwood industry. This development is expected to continue in the future with the market requirements on higher and similar technical quality and through the standardization by information technology. Thus, it looks like a movement towards a mega structure of the sawmilling industry.

But it is not only the sawmilling industry moving in this direction, the lumber retailers are also doing it. Recently a retailers group with participants from Austria, Germany and Switzerland was established. Furniture retailers are also getting bigger and fewer and the same is the case with Do-It-Yourself markets. As discussed in Section 5.1 these latter concentrations force the sawmilling enterprises and mills to become bigger and more efficient in the future.

Table 9: The 25 largest coniferous sawmilling enterprises in Europe in 1998 with changes in 1999. Production in million m³.

1998		1999	
Name	Production	Name	Production
Stora Enso, Finland	4.60	Stora Enso, Finland	5.30
Metsä-Timber, Finland	2.17	Metsä-Timber, Finland (Finnforest)	2.50
UPM-Kymmene, Finland	2.10	UPM-Kymmene, Finland	2.10
AssiDomän, Sweden	1.20	Moelven, Norway	1.80 ^a
Moelven, Norway	1.10 ^a	Klausner Holz, Germany	1.45
Klausner Holz, Germany	0.93	Klenk Holzwerk, Germany	1.30
Klenk Holzwerk, Germany	0.90	AssiDomän, Sweden	1.25
Fagerlid, Sweden	0.73 ^b	Graninge-SCA	1.15 ^c
Vapo Timber, Finland	0.70	Södra, Sweden	0.90
Norske Skog, Norway	0.68 ^a	Vapo Timber, Finland	0.70
Mellanskog, Sweden	0.67	Mellanskog, Sweden	0.67
SCA, Sweden	0.65 ^c	Mayr-Mellnhof, Austria	0.50
Södra, Sweden	0.61	Pfeifer Holzindustrie, Austria	0.43
Graningeverken, Sweden	0.57 ^c	Holmen, Sweden	0.39 ^d
Mayr-Mellnhof, Austria	0.50	Gebrüder Kühne, Germany	0.38
Pfeifer Holzindustrie, Austria	0.43	Rettenmeider, Germany	0.37
MODO-Iggesund, Sweden	0.39 ^d	Binder, Austria	0.37
Gebrüder Kühne, Germany	0.38	Siat-Ferdinand Braun, France	0.35
Rettenmeider, Germany	0.37	Ante Holz, Germany	0.34
Binder, Austria	0.37	Anton Heggenstaller, Germany	0.34
Siat-Ferdinand Braun, France	0.35	Holzindustrie Hasslacher, Austria	0.31
Ante Holz, Germany	0.34	Escobois, France	0.30
Anton Heggenstaller, Germany	0.34		
Holzindustrie Hasslacher, Austria	0.31		
Escobois, France	0.30		

^a The sawmilling industry of Norske Skog was merged with Moelven.

^b Fagerlid has gone bankrupt with no production in 1999 and is for sale.

^c The dominating part of SCA sawmilling was merged with Graninge.

^d MODO-Iggesund was reconstructed to Holmen.

5.3 Subsidies

Since 1999 subsidies, in the form of co-financing between the EU and a number of state governments, are not allowed for sawmilling enterprises (or any solid wood product enterprise) for companies having 250 employees or a turnover above 40 million Euro. It would not change the rules if the enterprise would be split up into smaller units. In spite of this, there have been massive subsidies to the sawmilling industry in a number of famous cases and the most well known is the grant schedule in former Eastern Europe. This has been possible due to the fact that the above rule does not apply to Regional or Cohesion Funds or to state aids.

With the collapse of the German Democratic Republic the existing wood industry collapsed too. The harvest dropped from 11 million m³ to 3 million m³. The federal German Government of the United Germany initiated different economic development programs and investors could obtain grants for 50% or more of the investment costs for new manufacturing mills. This resulted in investment decisions in the former East Germany (the New States) of a sawmilling capacity corresponding to 3.5–4 million m³ (UN, 1999). This granting has substantially contributed to the concentration effects in the European sawmilling industry.

It can be expected that in the future the EU will keep a closer control on these kind of grant schedules but the state aid may continue especially in non-member countries of the EU.

5.4 Does the Size Matter?

A long-term classical issue in the sawmilling industry has been the question whether or not economy of scale exists. This discussion has concentrated on the economy of scale at the mill level. It will start to discuss the issue of economy of scale at this level.

A number of studies argue that there is no economy of scale in the sawmilling industry at the mill level (e.g., Rogstad, 1975; Gustavsson, 1979; Warensjö and Jäppinen, 1997; Skog and Såg, 1999). Others argue that economy of scale exists at the mill level (e.g., Dobie, 1973; Haugland *et al.*, 1978; Banskota *et al.*, 1985; Martinello, 1985; Steele and Risbrudt, 1985).

During the later years there are reasons to assume that the economy of scale really is an issue. I have used the latest studies I could find on this issue in order to illustrate the possible economy of scale in European mills (Jaakko Pöyry, 1995; Fohlin and Silver, 1997). In Figure 4 we can see that the production costs in a 420,000 m³ sawnwood mill are about 80% of the production costs of a 40,000 m³ mill. If the wood procurement, delivery costs of final products and transportation costs for chips are included the economy of scale would lead to 15% lower costs for the 420,000 m³ mill compared to the 40,000 m³ mill.

The curves in Figure 4 are supported by German statements that in the future there will not be any mills smaller than a production level of 400,000 m³ of sawnwood. In addition, Jaakko Pöyry (1995) suggests that large sawmills integrated with pulpmills will have substantially better financial results compared to a “standing by itself” sawmill (doubling the impact of economy of scale).

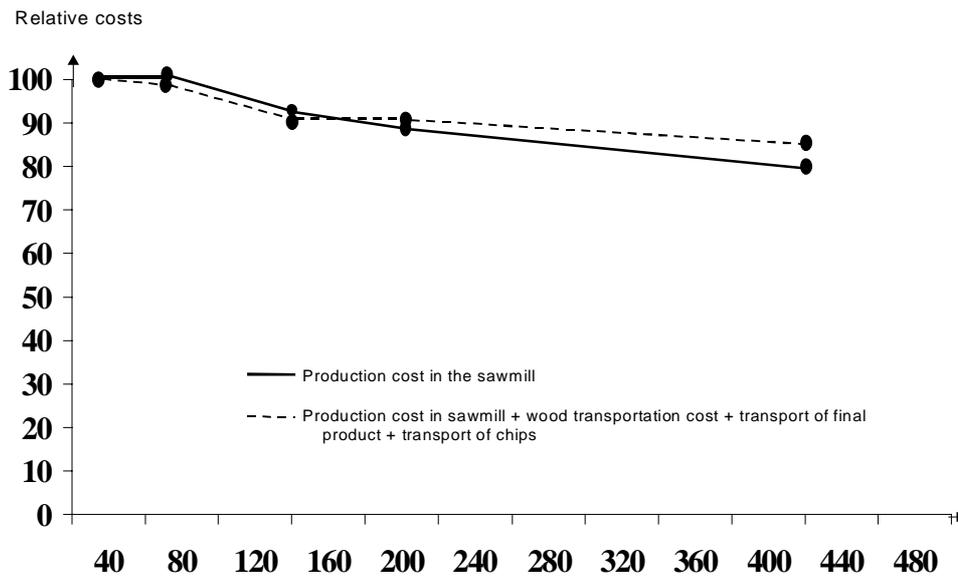


Figure 4: Economy of scale in sawmills.

But it is also obvious, that with the structural change of the markets and connected distribution following internationalization, there are other dimensions of economy of scale in place today. After dialogues with a number of sawmilling companies I am bound to conclude that there are also scale of economies at the enterprise level in the form of two features. The first feature is at a regional level where economy of scale seems to be in place due to the possibilities for product specialization, raw material procurement and distribution. The second feature is at the multinational level where economy of scale can be created through improved market organization, branding, financial capacity, product development, human resources, distribution network, strategic alliances and capacities to meet “new/changed” actors in distribution and retailing. It seems like the highest possibility to create Value under the current and future mid-term market conditions is at the multinational enterprise level. These conclusions are summarized in Table 10.

Table 10: Possible economy of scale in the European sawmilling industry. Production level in m³/year.

Level and Efficient Scales	Factors
Individual Mill Level: 200–400,000 m ³ /year	Production factors
Regional Enterprise Level: 400–1,000,000 m ³ /year	Product specialization, raw material procurement, distribution, management
Multinational Enterprise Level: 2.5–10 million m ³ /year	Market organization, branding, financing, distribution, strategic alliances and capabilities to challenge “new” actors in distribution and retailing, human resource capacity, product development.

However, the economic optimal size is very much dependent on the market segments in focus. The more focused and the more high value added segments require less volumes.

In a global situation with constrained markets and small economic margins it seems to be plausible to assume that the economy of scale (at different levels) will play an even more important role with respect to the concentration of the European sawmilling industry. There is also a possibility that we will see more and bigger new mills established as integrated mills of pulp mills.

The above-discussed economies of scales are researched to a limited scale and need more deep analysis. It should also be pointed out that the above picture may change substantially with a large scale implementation of the new information technology in the sector (see Table 11).

Table 11: Potential cost savings from business-to-business e-commerce (industry savings as percentage of total costs). Source: European Voice (2000).

Aerospace machinery	11	Health care	5
Chemicals	10	Life sciences	12–19
Coal	2	Machinery(metals)	22
Communications	5–15	Media and advertising	10–15
Computing	11–20	Maintenance/repair services	10
Electronic components	29–39	Oil and gas	5–15
Food ingredients	3–5	Paper	10
Forest products	15–25	Steel	11
Freight transport	15–20		

5.5 Substitution and Technological Product Development

Product preference is constantly changing due to product innovation and changing consumer preferences (Burrows and Sanness, 1998; 1999). Product price (including purchase and maintenance costs) continues to play an important role in product selection, as well as the quality of the product. But also factors like cultural preferences, perceived value, environmental aspects, etc., are of major concern. The forest products industry competes mainly with the plastic, aluminium, steel and concrete industries. Burrows and Sanness (1998; 1999) present an industry benchmarking (Figure 5), summarizing the strengths and weaknesses of these industries. They also present environmental benchmarking (Figure 6).

Burrows and Sanness (1999) conclude that steel and concrete are serious threats to forest products in construction and that building cladding materials and framing materials are highly contested.

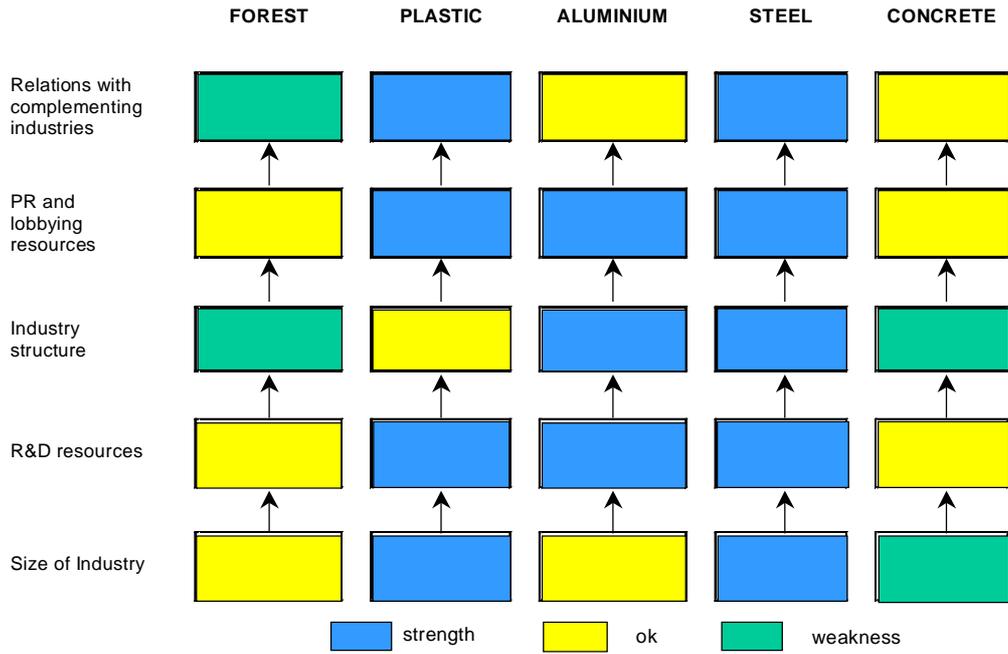


Figure 5: Industry benchmarking semaphore. After Burrow and Sanness (1999).

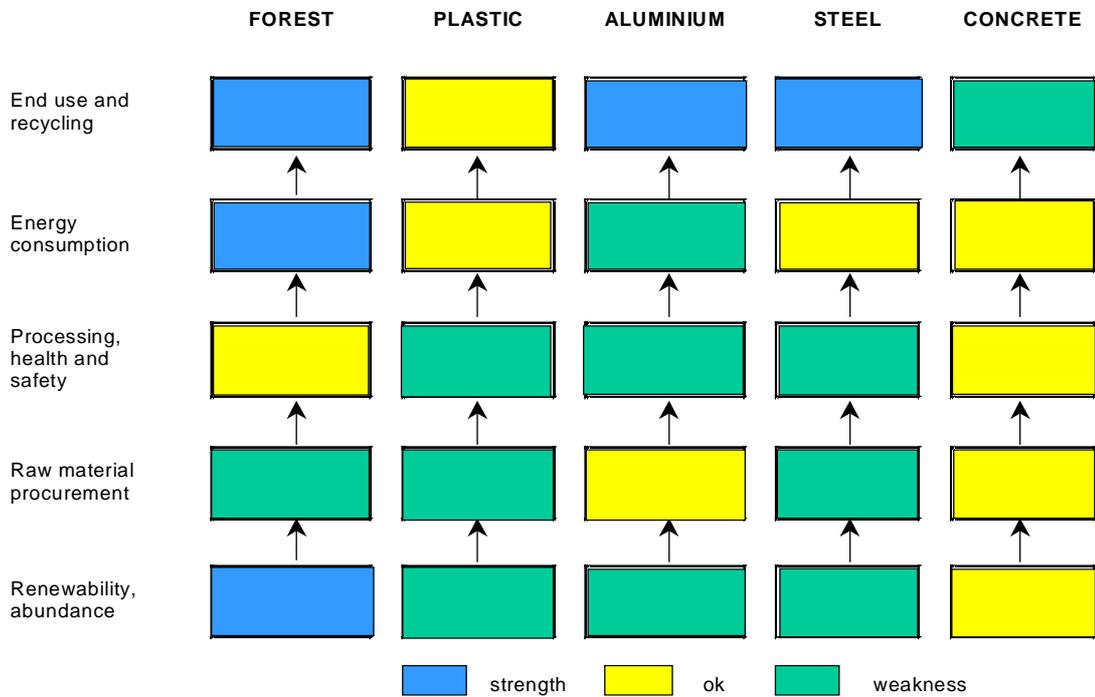


Figure 6: Environmental benchmarking semaphore. After Burrow and Sanness (1999).

The material substitution in the US residential construction industry moves quickly (Fleishman *et al.*, 1999) and is a signal about the upcoming situation in the rest of the world. Fleishman *et al.* (1999) report that residential builders have increased their use of substitute structural materials (versus coniferous sawnwood) since 1995 (Figure 7). During the period 1995–1998 the authors report the following losses in market shares for coniferous sawnwood: wall framing 10%, floor framing 17%, and roof framing 11%. Engineered wood products emerged as the clear winners in the form of glulam beams, wood I-joists and laminated veneer sawnwood. The authors also assess the builder satisfaction with coniferous softwood (Figure 8). As seen from this figure the quality aspects of coniferous lumber are more a reason for substitution than the price.

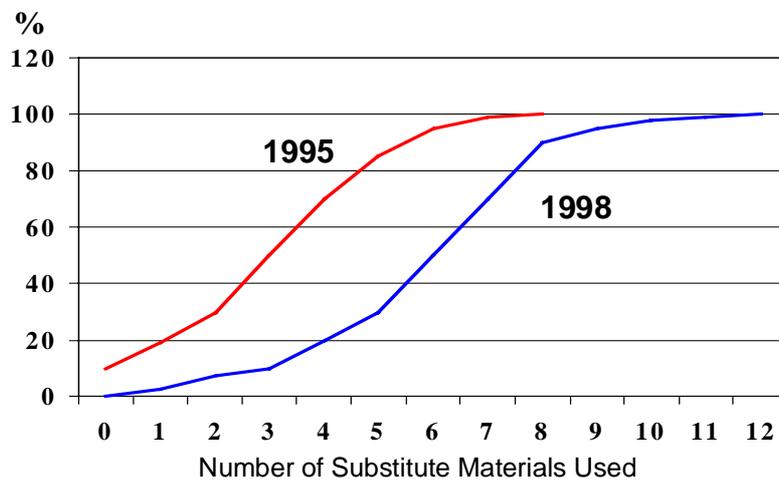


Figure 7: Number of substitute building materials used, 1995–1998. After Fleishman *et al.* (1999).

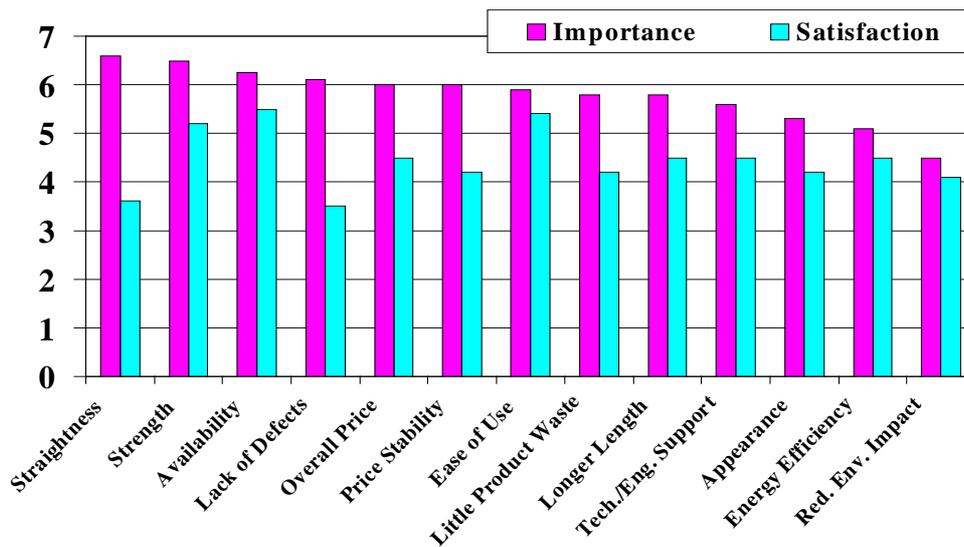


Figure 8: The gap between importance and satisfaction rankings of thirteen product attributes. After Fleishman *et al.* (1999).

In the following paragraphs I will illustrate some ongoing substitutions in Europe. In the European residential construction industry about 5 million tons of plastic is used per year. Recycled plastic composites for outdoor products and plastic facades are very competitive with wood. This is illustrated for the USA in Figure 9.

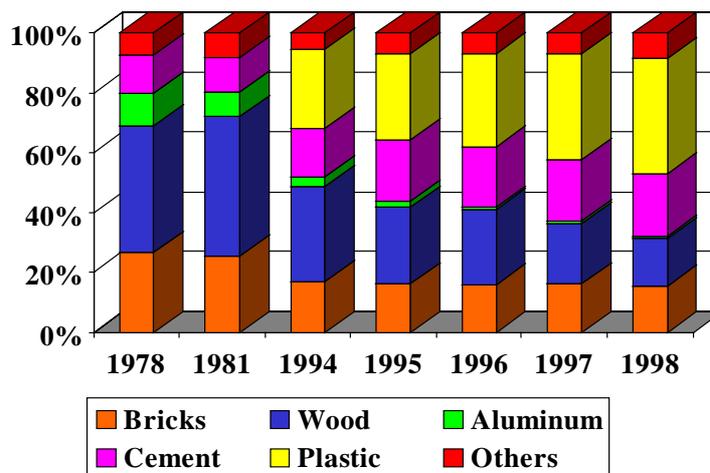


Figure 9: USA, Material for outdoor facades in new single family houses. After STEF (2000).

In Europe, MDF is increasing its market shares in furniture, panels, mouldings and flooring. Europe is the biggest market for MDF and the yearly average increase in consumption has been 17% since 1989, which can be compared with a growth rate of 0.3% for coniferous sawnwood during the same period (Figure 10).

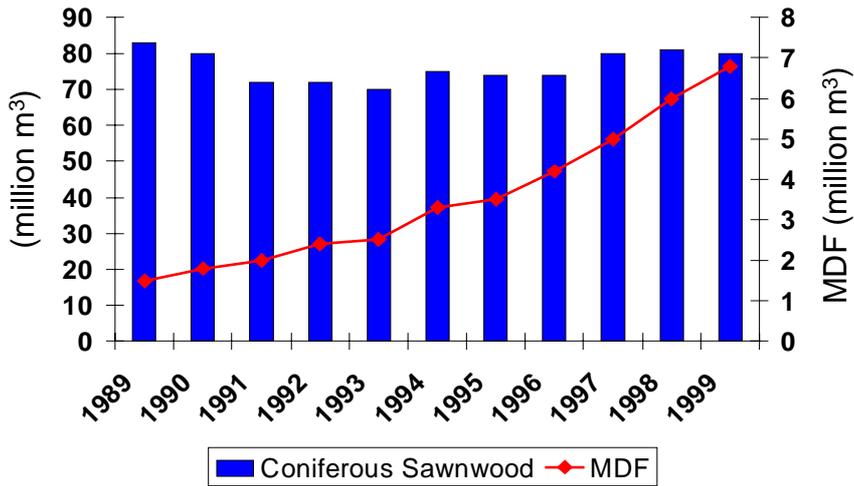


Figure 10: Western Europe, Consumption of MDF and coniferous sawnwood. After STEF (2000).

The European window market consists of 83 million window units. Plastic has a market share of 38% (increasing) and wood 33% (decreasing). Laminate flooring now has a similar market share as wood in Europe (Figure 11).

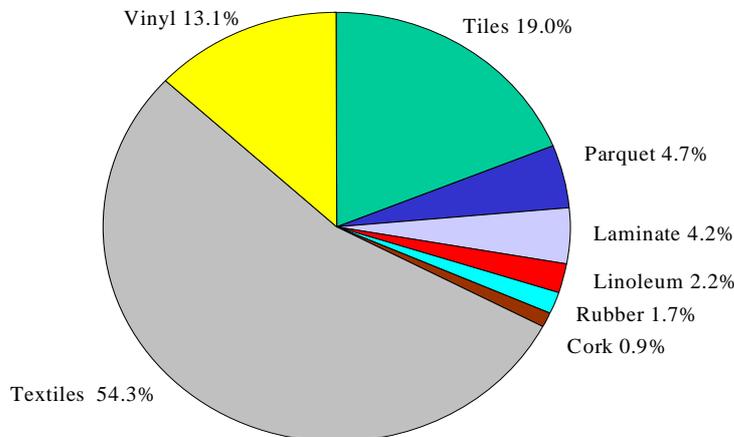


Figure 11: Market shares in Europe for floor cover. After SHIV (1998).

There is also a substantial technological development of solid wood products underway. Of special interest is the development of engineered wood products (EWP). Timwood (1998) identifies that within the time horizon of 2010 we will have the following new EWPs on the market:

- Oriented Strand Lumber (OSL);
- Timber Strand;
- Complete Residential Construction Systems; and
- Laminated Veneer Lumber.

There is also crucial technological breakthroughs expected of composite particleboards for construction purposes.

The technological development in the form of composite panels and EWPs will change the competitive position between different solid wood products in Europe (Timwood, 1998). The major changes are:

- Increased use of inexpensive raw material like aspen and poplar;
- Composite particleboard for construction;
- Oriented Strand Lumber; and
- Flaked Parallam.

Thus, increased substitution and technological developments are expected in Europe, which will change the competitive position of sawnwood successively.

This development is linking back to Section 5.4 due to the fact that in order to meet the threats of substitution and the technological development through EWP the sawmill enterprises have to be big in order to be able to invest in the required technological development of sawnwood.

There are also a lot of challenges around for technological developments and new products of solid sawnwood. One such example is the so-called “thermo wood”.

5.6 State of the European Sawmilling Industry

One approach to judge the development stage of an industrial sector is to apply the so-called wave-theory based on Kondratiev (1935), Schumpeter (1961), and Mensch (1979). Lönnstedt *et al.* (1983) used this concept for problem identification in the Swedish forest sector in the early 1980s. According to Mensch’s (1979) theory the development of an industrial sector can be divided into three phases.

The first phase (Phase of Establishment) is characterized by establishment based on basic innovations. The investments made are targeting to improve the innovation. The domestic market is the primary target and demand is supply driven.

The second phase (Expansion Phase) is intensive. Investments are made for technological development and increased production. The real price on the final product decreases costs for labor and raw material increase. The output becomes more and more standardized.

The third phase is the Stalemate Phase. This phase is a signal for crisis. There are hesitations about continuing as before. Fast pay-offs and risk-free investments are sought. Investments for increased productivity costs dominate. Foreign investments increase substantially. Mergers and integrations increase. Profitability decreases.

Of the indicator's discussed earlier in Section 5 it can be concluded that the European sawmilling industry is in the Stalemate phase. Only the wood availability indicator would argue for the sawmilling industry being in the expansion phase.

It is obvious that the European sawmilling managers have realized this situation. Baudin (1999) points out that the managers are now setting priorities on issues like:

- System products in the construction industry;
- Value added production;
- End-use analysis;
- Substitution;
- Integration of the wood industry; and
- International trade.

6. Panels

In Section 5 I have concentrated the discussion on the sawmilling industry and in this section I will bring up some development trends with respect to the panel industry. The production development of different panels in Europe according to EPF (2000) and FEROPA (2000) is presented in Table 12.

Table 12: Production of wood-based panels in EPF member countries in Europe, in 1,000 m³, 1995–1999.

	1995	1996	1997	1998	1999
Particleboard	28,800	29,000	31,600	32,200	32,900
MDF	3,800	4,500	5,400	6,300	7,100
Plywood	2,400	2,500	2,600	2,600	2,900
Hard-/Softboard	1,700	1,700	1,700	1,700	1,700
Wood-based panels, total	37,000	38,100	42,000	43,600	45,600
Sawnwood, coniferous + non-coniferous	117,800	113,300	116,100	120,300	121,100

The plywood production shows an increase in 1999 but it should be pointed out that Finland has 38% of the production share and fluctuations in Finland's production influence strongly the European aggregated production figures.

The production of wet processed fiberboards (hard/softboard) has been stable during the second half of the 1990s with production of around 1.7 million m³. In 1999 there was a drop in the production in Eastern Europe of about 8%.

The particleboard production set a new record with production of 32.9 million m³ in 1999. An upward production trend has characterized this industry since 1983. The raw material consumption in 1999 was constituted by virgin wood (29.1%), industrial residues (54.6%) and recycled wood (16.2%).

MDF production increased strongly during the second half of the 1990s and there was a production increase between 1998 and 1999 of 13% and the capacity expansion was 26%.

There has been a dramatic increase in OSB production since 1994 (commercial production of OSB started this year in Europe). The increase in production between 1998 and 1999 was 25% due to a higher utilization rate of existing mills. It can be concluded that MDF and OSB are still in the Establishment Phase, to use Mensch's (1979) classification, particleboard is in the Expansion Phase and wet produced fiberboards and plywood are probably in the Stalemate Phase.

6.1 Outlook

In Table 13 assessments on possible development of some parts of the European panel industry are illustrated.

From Table 13 it can be seen that the production of particleboard is assumed to increase in Europe but the consumption is assumed to flatten out. A dramatic development is foreseen in both consumption and capacity increases in MDF and OSB in Europe. This will influence the consumption of sawnwood in Europe.

Table 13: Possible development of some parts of the European panel industry. Calculated from EPF (2000) and expressed in million m³.

	1996	1999	2002	2004
Particleboard				
• Consumption	27.8	31.0	31.5	31.8
• Production	29.0	32.9	35.3	37.0
MDF				
• Consumption	4.2	6.8	10.2	12.6
• Capacity	6.6	9.4	13.3	16.6
OSB				
• Consumption	0.4	1.0	2.4	4.2
• Capacity	0.8	1.1	2.5	4.3

6.2 Structural Change

There will probably be a similar trend to structural change in the panel industry as discussed in Section 5 for the sawmilling industry, however, to a lesser degree (Hazley, 2000). But a concentration of the industry is assumed with investments in larger units (e.g., the New States of Germany) (SHIV/ASIB, 2000) and mergers to create the larger companies to meet the market and distribution demands and to meet the demands on product development.

7. Overall Outlook for the European Solid Wood Industry

From the analyses made in this paper the following overall conclusions can be made.

Market opportunities

The traditional markets for solid wood products are saturated and the market opportunities are in Eastern Europe, China, Asia and Africa. There is a high probability that the other producing regions will concentrate their efforts to these markets. Competition will increase substantially. The products being exceptions from these developments are OSB and MDF, which are expected to have an impressive growth in the Western European, US, and Japanese markets.

Price development

The price development for solid wood products (except OSB and MDF) is expected to stabilize around the 1994 price level.

Wood balances

The European wood resources do not constitute any hindrance for substantial expansion of the European solid wood industry. With respect to sawnwood, the available resources in 2010 would allow a 13–38 million higher sawnwood production compared to current production. If European Russia, Belarus and Ukraine are also included, the figures would be 27–78 million m³ of sawnwood.

Structural change

The sawmilling industry is expected to go through dramatic structural changes in Europe. The substitution of sawnwood by other materials than wood is expected to increase and the competition by Engineered Wood Products, OSB and MDF will increase substantially.

The industry will be much more concentrated through larger mills (yearly production of 200–400,000 m³ of sawnwood) and larger enterprises at both the regional (about 1 million m³/year) and multi-national levels (2.5–10 million m³/year). A substantial economy of scale exists in all market issues and the distribution.

The other panel industry will go through a similar development but may be less dramatic compared to the sawmilling industry.

The EU has recently carried out a major study with the objective to assess the competitive position of the EU woodworking industry by identifying strengths, weaknesses, opportunities and threats (“SWOT-study”) (Wall, 2000; EPF, 2000).

A summary of the SWOT analysis of the European woodworking industry is presented in Table 14.

The results of the SWOT analysis are in line with the conclusions made earlier in this paper and highlights the urgent need of promotion for increased wood consumption in Europe.

Table 14: Summary of SWOT analysis of the European woodworking industries. After Wall (2000).

<p>Strengths</p> <ul style="list-style-type: none"> • Sustainable and expanding raw material base • Strong technology, know-how and skill base • Proximity and access to one of the world’s largest and sophisticated markets • Industry clustering and development of home-base advantages. 	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> • Relative lack of wood culture, stifling opportunities to rejuvenate markets • High raw material costs (especially wood) • High labor costs • Low profitability, reducing opportunities to re-invest, support R&D and create critical mass to consolidate and rationalize.
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> • Expanding the use of wood: <ul style="list-style-type: none"> ▪ promote wood as a lifestyle product ▪ broaden product propositions, create solution packages for end-users • Further development of home-base advantages around clustering, synergies between subsectors (e.g., geographical, know-how, technological, supplier, infrastructural) • Capitalizing on the expanding EU forest resources • Participate in the supply chains from cost competitive regions. 	<p>Threats</p> <ul style="list-style-type: none"> • Competition from Eastern Europe, Russia, South East Asia and Latin America established and low cost resources • Failure to develop products and solutions, leading to increasing substitution by other materials • Failure to capitalize on environmental initiatives.

In Figure 12 the competitive position of different subsectors of the European solid wood industry is presented. The EU study concludes that MDF, OSB, Particleboard and Softwood plywood in Europe have a strong position. However, the rest of the solid wood industry is in a weak competitive position.

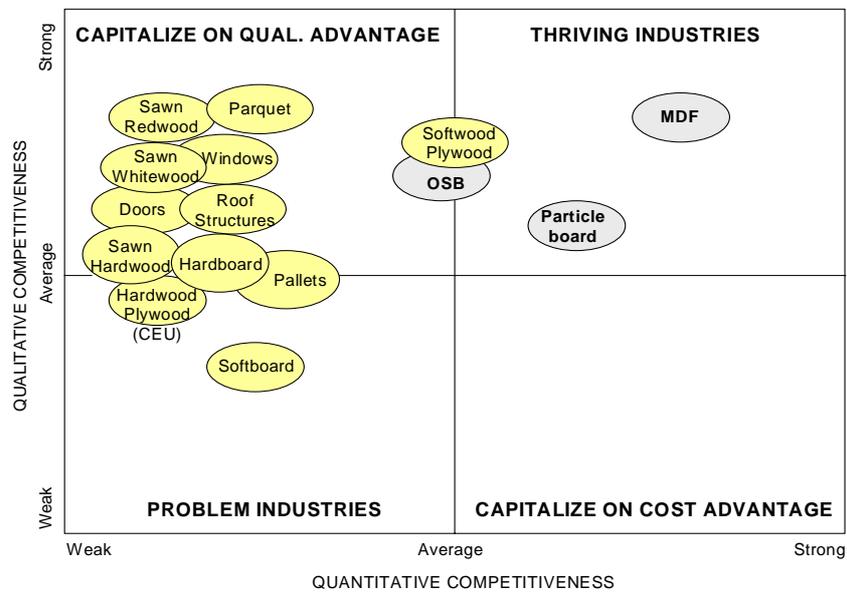


Figure 12: Summary of qualitative and quantitative competitiveness analysis • position of EU industries. After EPF (2000).

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