

DEVELOPMENT OF WOOD-BASED PRODUCTS WORLDWIDE¹

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Abstract

The tendency in recent decades for manufacturing plants of semi-finished products such as composite panels, has been to invest in order to achieve high production capacities (>2,000 m³/day for panels and >3,000 t/day for paper with one line). The trend of concentrating the primary processing capacities and manufacturing wood-based panels will continue for the next few years not only in Europe but in North and South America as well. The ten largest panel manufacturers had a combined manufacturing capacity that exceeded a third of the worldwide production capacity. The financial crisis that started in 2008 has caused the closure of a large number of factories especially in North America and Central Europe. Small- and medium-sized producers will only survive if they will continue to specialize in the manufacture of panel types and sizes (niche products) that are "unprofitable" for mega-groups.

The installed production capacity worldwide of all wood-based composite panels combined (includes PY, PB, MDF, OSB) rose by more than 2.5 times between 1980 and 2005 (225 mil.m³), and continues to increase despite the crises reaching approx. 300 mil.m³ in 2013. The forecast for the coming years varies greatly from continent to continent. In North America and Central Europe, both a consolidation of the available production capacities and the closure of less efficient older lines are expected. The lowest point of the effect of the financial crisis on the building industry seems to have been overcome. The furniture production companies will continue to move from one continent and region to another.

Key words: plywood; particleboard; fiberboard; OSB; pellets; WPC.

WOOD-BASED PANELS

Europe is currently home to more than 20% of the world's production capacity for wood-based panels (67 mil.m³), figures which actually represent a decrease of 5 to 10% in the last ten years. At the moment, additional production capacity is only being set up in countries outside the EU15, particularly in the Commonwealth of Independent States (CIS). The main panel producers in Europe are Germany and Russia (each with about 10 mil.m³) followed by Turkey (7 mil.m³) and France and Poland (each with about 5 mil.m³). Russia and Turkey have increased their capacities significantly. Romania and Ukraine will become important players in this industry in the near future. The main market share in Europe belongs to an Austrian group of owners; with 5 leading companies being responsible for more than half of the European capacity. The top 10 in Europe produce around 75% of Europe's output. The availability and quality of raw materials determine the type and location of the panel industry in Europe. The South is specialized in particleboard, the Alps and central region in softwood mills, pulp & paper and also in the MDF industry. Glue laminated timber (GLT) and other similar construction type products like cross laminated timber (CLT) have increased their market share, replacing in many buildings concrete and steel. The huge urban areas provide recycled wood which was only used for particleboards and now has to be shared with the biomass energy producers. Pellets and briquette production has also increased to an unexpected capacity of 23 mil.t in only 10 years in Europe and caused competition on the raw materials market, especially for sawdust high production capacity units which forced small mills to merge or close. In 2010, according to the European Panel Federation (EPF), the European wood working industry generated more than €201 bil., employed 2.1 mil. staff in

¹ This part contains also data offered by courtesy of the CSIL (2012-2014), European Panel Federation (EPF) in Brussels (2014) Eurostat (2011), EUWID (2012), IKEA (2014), Journal of Wood based Panels (2010-2013), MDF-Magazin (2013-2014), Pöyry (2009-2014), UNECE/FAO (2013), and also on many papers of the authors (Barbu et al. 2014, Irle et al. 2013, Paulitsch 2013, Paulitsch and Barbu 2015 etc.).

more than 300,000 companies. Around 46% of the turnover was generated by the furniture sector and 40 % by the wood-based products for construction.

After more than one decade, **plywood** (PY), in terms of the volume produced, is again the most important panel type, even before particleboard. However, its importance is dropping in developed countries due to the severe lack of appropriate raw material and high labor costs. MDF and OSB boards tend to substitute it, offering economic benefits, in furniture manufacture and in constructions. From 1992 to 2007, there has been an increase in plywood production worldwide from 52 to 78 mil.m³. After the lowest production year in 2009 (only 66 mil.m³), the consumption of plywood has risen again to over 81 mil.m³.

China is now the biggest plywood manufacturer and consumer (55 mil.m³), surpassing the USA (9 mil.m³), with a positive tendency as regards the evolution of capacities. In North America, Central Europe and Oceania, a constant decrease in the production capacities can be noted. South-East Asia, Russia, and Eastern Europe are other regions with a positive evolution in this respect. Malaysia produces 5 mil.m³ followed by Japan, Brazil, India and Russia with about 3 mil.m³ each. The USA consumes approx. 12 mil.m³ followed by Japan with 6 mil.m³. Canada, India and South Korea use about 3 mil.m³.

European production capacity (including Russia and Turkey) is only 6 mil.m³. In Europe, plywood consumption represents 10% of global production and is covered by 60% of imports. The main users of plywood are England and Germany with about 1 mil.m³. Holland, Italy and France use about 400,000m³ yearly.

Particleboard (PB) kept its significant market share for decades with its popularity worldwide, but lost ground in North America and Central Europe (with over 3 respectively 6 mil.m³ in the last 5 years) as well. An unexpected invigoration of the production capacities can be seen lately in South-East Asia, Latin America and Eastern Europe.

The demand for particleboard has been constant due to the cheap raw materials, derived from recycled wood and its very low price compared to MDF (<50%). The increased use of recycled material has become state of the art and factories are using equipment for the preparation of this type of raw material. An aspect to be improved is still the on-line detection of contaminants in the recycled material. Europe including Russia and Turkey (>50 mil.m³) is still the leading producer of the world (>50%). The main producers in 2012 were China (11-14 mil.m³), Russia, Germany, USA and Canada (about 5.5 mil.m³ each). The consumption of PB in the USA decreased from 2008 until 2012 by about 40%. After Russia another newcomer in Europe is Turkey (4 mil.m³) surpassing producers like France (3.9 mil.m³) and Poland (2.8 mil.m³). Italy, Austria and Spain are further important producers in Europe. The main use of particleboard in Europe is for the furniture industry (>50%) because of the existing processing technology, its low weight and price compared to other panels. A new generation of light particleboard with a density of less than 500kg/m³ (Airmaxx-Kauritlight, Balanceboard, BoBoard, SuperPan light) is now available on the market. New tougher regulations for formaldehyde emission for particleboard were implemented after 2009 in North and South America, Europe and Asia.

Oriented Strand Boards (OSB) production has experienced rapid growth of more than 40 % in the same decade. Approximately 85% of the global production capacity is concentrated in North America, where OSB was launched as a building material to the detriment of plywood and particleboard. The production in the USA was about 11 mil.m³ in the year 2008 and fell to 8.5 mil.m³. In 2012 the produced volume reached 40% (12.5 mil.m³), which is the same level as before the economic crisis. The annual production capacity has doubled in Europe over the last decade, reaching more than 4.7 mil.m³ with 15 manufacturing lines. Germany continues to be the main producer (1.2 mil.m³), followed by Romania (0.8 mil.m³), Poland and Bulgaria (0.6 mil.m³ each), France, the Czech Rep. and Latvia. OSB is mainly used (80%) in the building industry for cavity walls, ceilings, floors, staircases, webs for I-beams and packaging etc. Volatile organic compounds (VOC) from pine strands and increasing requirements for indoor air quality are new challenges. Further investments are forecast, not only in Eastern Europe but also in Russia and Turkey, Latin America (Brazil and Chile), Asia (China also from bamboo and rice straw) which could double the existing production capacities.

Medium Density Fiberboard (MDF) production has increased at an astonishing rate of about 4 mil.m³/year on a worldwide basis since 1995 reaching today 70 mil.m³. In the last decade, a lot of this growth has occurred in China and its neighboring regions, as well as in South America, rather than in Europe and North America where the initial boom took place. The worldwide production distribution looks as follows: more than two thirds in China, less than one quarter in Europe (more than 16 mil. m³ installed capacity), and the rest shared between USA, Asian countries (without China) and Latin America. Today the consumption in China is about 51 mil.m³. After 2008 the production in USA dropped to 2.5 mil.m³ and the consumption is less than 4 mil.m³. The main producers in Europe are

Germany (4.1 mil.m³), Turkey (3.1 mil.m³), Poland (2.6 mil.m³), Spain (1.5 mil.m³). Russia, Italy, France and the UK have installed capacities for over 1 mil.m³/year.

The main use of MDF is for furniture (55%) as substrate panels. One third of MDF is produced as thin High Density Fiberboard (HDF) and coated for flooring (over 900 mil.m²). The installed overcapacity in China and Europe and price instability have required manufacturers to keep their production constant or to reduce it. The next few years will be very interesting for MDF because the dramatic drop in furniture sales due to the unstable financial situation and low number of buildings has started in the USA and Eastern Europe. As for all panel types, MDF is subject to new tighter regulations on formaldehyde emission. Fortunately, for the manufacturers these limits are slightly higher than those for particleboard. A reduction in weight, especially for thicker boards, is in great demand by customers. Ultrathin HDF (1 to 2mm) are produced in over a dozen lines in the world and used as decks in honeycomb multilayered boards.

The amount of **wet processed hard(fiber)boards** (HB) decreased drastically to some millions m³ during the last decades, due to low productivity, limited thickness to 10mm and severe environmental requirements imposed on technological processes in highly industrialized countries.

The fiber-based insulation board (<300kg/m³) market in Europe, particularly in Germany, Switzerland and France is presently in a renaissance (1 mil.m³). Insulation products made of regenerative raw materials are about twice as expensive as classic insulation products from rock wool or artificial foams and could only be partly established on a large market.

Parquet including all types of multilayered structures has shown positive growth for more than two decades. Today about 87.5 mil.m² of parquet was produced in Europe. The most widespread type of parquet is the laminated type (over 80%) due to its reasonable price, high performance and easy installation. 3-layer parquet constitutes 43% of the total amount, 41% long flooring elements and only 15% of parquet is the single layer type. The main European manufacturers are Poland (20%), Germany (16%) and Sweden (13%). The main users are Germany (24%), France (14%) and Italy (10%). Parquet consumption varies depending on the region and product type, being 0.23m² per inhabitant, on average. The peak ratio of 0.7m² per inhabitant is attained in Austria and Sweden. However, the greatest parquet-consumer countries are Germany (22%), Spain (18%), Italy (15%) and France (11%). Although the price of solid parquet and labor costs are high, the consumed volume remains steady (15%).

Laminated HDF floors represented in 2012 together with parquet and other types of solid wood floors about 1.6 bil.m² which is only 13% of the total world flooring market. In the Asia-Pacific region about 42% of wooden based floors are used, followed by Europe (21%) and the USA (10%). The laminated floors are produced in 7.5 mm and thinner (45%). The same results relate to the floors of 8 to 9 mm thickness and only 10% for over 10 mm thick. The European producers (incl. Turkey) of laminated floors have 55% of the world production manufacturing with about 500 mil.m². Germany has the same amount as Eastern Europe, yearly about 80 to 100 mil.m². Turkey can be considered an increasing market, using 50 mil.m² of laminated floors.

Wood Plastic Composites (WPC) now has an impressive forecast after over 25 years of developments and slow acceptance on the plastics market with 3.5 mil.t for 2011. North America produces about 1 mil.t of WPC. The Chinese producers have made great efforts to book a significant capacity increase of 30% for the near future from 2.4 mil.t in 2013 to 5 mil.t in the year 2020. In USA the amount of WPC used in decking has increased 12-fold in the last 10 years. In 2013 Europe produced about 260,000 t of WPC from which 140,000 t for decking and 90,000 t made from natural fibers (NFC). The main processing technique used for WPC (2/3) in Europe is extrusion. The other 23% of WPC is used in Europe for the car industries using pressing technologies.

Wood Wool Cement Bonded Boards (WWCB) registered closures of old and small equipment in the competition with new composites. In Europe only 20 mil.m² of WWCB are produced by a few companies included in big construction materials manufacturing groups located in Austria, Denmark, Germany, France, Italy, The Netherlands, Sweden and Switzerland. A new generation of modern equipment with a daily line capacity of 3,000 m²/shift is now delivered from European machine manufacturers to Russia and China, which are the potential markets for such products.

Pellets, which were launched on the market in the year 2000, reached the unexpected production of 16.6 mil.t in the year 2010. About 65% of this amount was produced in Europe including Russia. Only after 2 years (2012) did the production further increase to 22.4 mil.t, of which 12 mil.t were used in Europe. Until 2020 the forecast estimated a capacity increase to over 45 mil.t by doubling the existing production in Europe (to 18 mil.t). For the same time span North and South America have been forecast an increase of 34% and for Asia-Pacific about 26% (12 mil.t). If the demand for pellets in Europe reaches about 24 mil.t, imports will continue to be required. After China, South Korea, Japan the consumption of pellets will increase significantly in the USA.

FURNITURE

Gaining market share through sale prices has become the crucial factor in the marketing of furniture around the world. The need for **customized furniture** and satisfying consumer tastes have made the designing of furniture an essential aspect in such considerations. The modernization of the furniture manufacturing processes by the aid of completely controlled production flows and centers, automatically and instantaneously adjustable according to the series to be processed, have created competition in this market. The forecast predicting the migration of the production centers from Western and Central Europe to the eastern part of the continent and further Far East was not really taken very seriously for a long time.

Surfacing materials like impregnated papers, low and high pressure laminates (HPL) etc. have increased in the last 15 years by 30% to 14 bil.m². The share of decorative veneers has decreased from 27% to less than 20%. Low pressure laminates (LPL) slowly continue to expand with a rise to 45% while high pressure laminates and foils stay constant at 9 respectively 15%. Direct liquid coatings make up only 7% of all surfaces.

Furniture request reached the value of 436 bil.USD in 2013, which is about 50% more than in the year 2005. The production value of furniture in the year 2013 was 450 bil.USD. The actual furniture trade is more than 2 times higher compared to the year 2002 (55 bil.USD). The forecasts for the year 2015 consider that the furniture demand worldwide will increase by over 3.5% compared to 2013. This forecast varies according to region: it is negative for Western Europe, under the world average for Eastern Europe (incl. Russia) and North America, slightly over-average in South America and Africa and double in Asia (6-7%).

Furniture production in Europe and North America will not continue to grow. From 2000 to the present, China has managed to triple its furniture production and to increase exports 14 fold (2014: 53 bil.USD); so that Chinese-made furniture represents 40 % of the total quantity produced by the USA and EC. This discrepancy results from the production costs in China being lower by 70 to 80% than in North America or Central Europe. The huge amount of furniture imports in the USA (2007: over 26 bil.USD) contributed to a clear downward trend for domestic production and can be seen in the outsourcing of manufacturing centers to countries far away from the USA. In 2014, the USA recovered in terms of furniture importation (2013: 26,3 bil. USD) and reached the level of 30 bil.USD like 2007 again (28% from China). The other nations which imported huge amounts of furniture in 2014 are Germany (13,5 bil.USD), France and UK (each 7 bil.USD). The same tendency is seen in the European market, too. In 2014 China became for the 10th time again the biggest furniture suppliers (53 bil.USD, +6% compared to 2013), followed by Italy (11 bil.USD: 15% for France, 11% for Germany, 9% for UK), Germany (<11 bil.USD: 13% for France, 12% for Swiss, 11% for Austria), and Poland (10 bil.USD, +25% compared to 2013: 39% for Germany). Vietnam became after massive foreign investment the 5th furniture exporting nation (6 bil.USD: 52% for USA).

The **furniture industry** has witnessed profound changes both in terms of the manufacturers and the diversity of products, which need to meet new customer requirements. The traditional furniture manufacturers in Central Europe and North America are finding it difficult to counter the competition from the new manufacturers from the countries under development in Eastern Europe and South-East Asia, which are little by little stifling them with quantity and low prices. Also Ikea and similar low budget furniture trading chains have greatly influenced the developments of the last few decades. The phenomenon Ikea exceeded specialist's forecasts by reaching a turnover of 29 bil.€ in 2014. The top selling countries are Germany (14%), USA (12%) and France (8%). Ikea employs 151,000 people (75% in Europe) in 345 shops and trading service offices and in over 42 countries. Over 211 mill. catalogues, showing about 9,500 products, were printed in 29 languages. Over 1000 suppliers of 51 countries are connected to this group but only 41% is wood from sustainable sources. Ikea Industry (forms Swedwood) has 44 own production units in 11 countries. 750 mil. people (2013: 775 mil.) visited Ikea shops and 1.5 bil. (2013:1.2 bil.) the website in 2014.

WOODEN STRUCTURAL ELEMENTS

Manufacturers of wooden prefab elements witnessed favorable growth in Europe and particularly in the USA, and quite considerable growth in the Far East, at least until the start of the financial crisis of 1997 in Japan, followed by the worldwide crisis in 2008. The global financial crisis had a very harsh effect on the building sector in the USA and for the moment, due to the huge number of new houses available, no new panel projects are predicted.

Finger-jointed timber has an important share in wooden building materials in Central Europe. The main producers are Germany, Austria and Switzerland. In 2012 2.6 mil.m³ were produced.

Glue Laminated Timber (GLT) totaled 5 mil.m³ in 2013 over North America, Europe and Asia. Europe increased its consumption from 1.6 mil.m³ in 2007 to over 3 mil.m³ in 2012. In the same period the consumption in Asia rose from 1.4 mil.m³ to 2 mil.m³ while in North America, consumption decreased from 750,000m³ to 285,000 in 2009. Current demand is estimated at about 400,000m³.

I-Beams in North America are used for the construction of houses while in Central Europe the double T-beams for shuttering carriers (formwork girders). Also the components for these beams differ between the two continents: LVL and OSB in America and finger-jointed timber and particleboard in Central Europe. About 20 mil.m (linear) of shuttering carriers beams worldwide 30 mil.m are produced in Europe. The highest I-beam amount manufactured in North America was 391 mil.m in 2004, decreasing to 120 mil.m in 2009. In the year 2013 the volume reached about half of that reached in 2004.

Cross Laminated Panels made of hardwoods are used for furniture, interior applications (3layer boards) and those derived from softwoods are used in construction (CLT). The production of one and multilayered panels in Europe is about 1 mil.m³. Outside Europe there are almost no real capacities for this process. Approximately 100,000m³ 3layer boards of 21 to 27mm are used in the furniture industry. Cross Laminated Timber (CLT) is produced mainly in Austria and Germany. In 2014 the installed capacity in Europe (mainly in the Alps region) was 800,000m³ and for the first time a few no. of small lines start to operate in Scandinavia, Canada and USA.

Laminated Veneer Lumber (LVL) is produced worldwide with a volume of about 3.5 mil.m³. Like OSB, the LVL capacities are installed in USA. It is primarily used in construction (2/3). In the year 2013 the production of LVL was 1.6 mil.m³. About 200,000m³ were produced in Canada and about 1 mil.m³ in Asia (China: 800,000m³) and used in interior applications, transportation and furniture. Japan is, after China, the 2nd largest user of (600,000m³). New Zealand and Australia are the bigger exporters of the region. In Europe, only Finland (Kerto) and since recently Russia produce LVL. In 2014 the 1st beech veneer LVL started to be produced in Germany (150,000m³).

Parallel Strand Lumber (PSL), Laminated Strand Lumber (LSL) and Oriented Strand Lumber (OSL), are all only produced in a few factories in North America (<200,000m³). **Scrimber** made from bamboo are produced in China for decking and furniture and start to be accepted in the European and North American market.

The unexpected rise in the price of steel now permits wooden construction systems to compete with the classic systems made of concrete and steel. The new wooden structures are sophisticated, particularly in their structural elements, developed with pre-designed high properties and meet the same requirements as the rest of the building materials. Fireproofness, large spans, low-weight, with high dimensional stability in various environments and, last but not least, easy and fast assembly are the characteristics of the new generation of wooden constructions. At the same time, legislation in Central European countries now favors the new wooden structures, allowing the building of multistory units made from CLT, of 10 floors and industrial constructions of various complexities. The price of such wooden constructions, the design availability and good insulation properties are competitive factors on the market. North America and Japan have started to amend their building codes in order to allow CLT based construction.

OVERVIEW

The installed overcapacity for wood-based panels (15 – 20%), especially PB and MDF, and the actual financial crises with a dramatic impact on building and furniture sales forced manufactures to reduce their production rate and sales prices to the level of production costs and to close old lines. The reduction of board weight and emissions on the one hand and the increase in use of recycled wood on the other hand is an important goal but not the solution which can prevent some of the companies from closing down. A harsh concentration of the existing capacities in some internationally active megagroups could be the short term forecast. Furniture made from low weight elements (sandwich type) and low emission panels especially for the “do it yourself” segment is a probable direction for developments in the near future. Other processing and finishing technologies adapted to the new quality of board (lightweight and low emissions) should be introduced into the market and accepted by processing companies.

The availability of subsidies for green energy generated from biomass (which requires approximately the same raw materials as for the particleboard industry) and regulations on environmental protection (waste air, waste water and noise) have created unequal competition inside the European Union and among the industries. Some regions have also offered large grants or tax reductions in order to encourage companies to install their production sites in a particular area and this has also created unfair advantages and distorted the market.

The new requirements for low formaldehyde emission panel products will increase the

competition between the producers and the moment of application could create supplementary pressure on the current world financial crises, the complex impacts on the wood processing industry are difficult to foresee.

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