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Prospects for Engineered Wood Products in Asia: Laminated Lumber, I-Joists and Glue Laminated Lumber

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1. **Introduction**

The main purpose of this paper is to provide an overview of engineered wood products, how and why they were developed, and what the prospects are for these products over the next five years. What are engineered wood products? What is the origin of their development, what are the driving factors behind their development, and what is the outlook for these products over the next five years, especially in the Asian region?

2. **Defining Engineered Wood Products**

There are both structural and non-structural engineered wood products. This paper will focus mainly on structural engineered wood products, products that can substitute for solid timber in structural applications. This excludes wood panels such as MDF and particleboard. There are three main structural engineered wood product categories:

- Laminated Veneer Lumber (LVL), and Strand Lumber (LSL),
- I-joists, and
- Glue laminated lumber (glulam).

Laminated Veneer lumber, strand lumber and I-joists are relatively new products. They have taken a significant share of the wood products market in North America, and have just begun to spread to other parts of the world, especially Australia and Europe. They have not yet made a significant impact in Asia, but the underlying conditions suggest that they might in the next decade.

Glulam has been used in Japan, North America, Australia and Europe for many years, and has been partially replaced in North America and in Australia by LVL and I-joists. The question is, will glulam and solid timber be replaced by other engineered wood products in Europe and Japan, to the extent that it has been in North America and Australia, or will it continue to be in high demand in Japan and other Asian countries?
PSL, LVL and I-joists are shown above. On the top left is parallel strand lumber, and to the right are laminated veneer lumber and I-joists.

PSL is currently manufactured only by Weyerhaeuser, from long strands of veneer, is very strong and is used for headers and beams. Oriented Strand Lumber and Laminated Strand Lumber are similar products, and are also similar to oriented strand board. The chips are aligned in the same direction, and like LVL the panel is re-sawn into lumber size dimensions.

LVL is similar to plywood, but the veneers are aligned in the same direction. The panel is re-sawn into lumber dimensions. Many plywood manufacturers produce non-structural LVL as an add-on to their plywood operations.

I-joists are generally made with an LVL flange and an OSB web, but more recently have been made with a solid timber flange, and in future will be made with a strand lumber flange. The web is sometimes made of plywood. A company in Australia is in the process of developing a manufacturing plant that will be able to produce both the flange and the web from eucalypt strand lumber. A company in the United States already has the capability to make I-joists with a web and flange both made of strand lumber.
In the above diagram, on the left, is a wood I beam with an LVL flange, and an oriented strand board (OSB) web. In the centre is oriented strand lumber, and to the right is an LVL beam. These products compete with solid timber beams, and can be substituted for steel in some applications. They are currently used mainly in residential construction, but could also be used in non-residential construction.

3. Development and Drivers of Engineered Wood Products

These products are at various stages of the product life cycle. What is their origin? How were they developed? What is driving their development? Key development drivers are environmental factors that are restricting access to the world’s resources, the performance of these products compared to solid timber, and population drivers. These are the key factors that have driven, and will continue to drive the development and use of engineered wood products. They are fundamental drivers, and will result in a rapid expansion in production and consumption over the next five to ten years, at the expense of traditional solid wood. There are significant opportunities, especially in the Asian region, where they are at a very early stage of use, but where the underlying conditions favor the use of engineered wood in place of solid timber.
Product life cycle

The diagram shows the approximate stage that LVL, I-joists and glulam are, on the product life cycle in North America. LVL and I-joists are both currently at a relatively early stage, and gaining significant market share.

Glulam is a more mature product, and lumber, the key product for which engineered wood products are a replacement, is in the advanced or declining stage of the product life cycle, and losing market share. Glulam will not likely gain much more market share in North America, while LVL and I-joists will continue to take market share away from sawn timber and steel.

In other markets, such as Europe, Australia and North Asia, LVL and I-joists have even less market share, and are at a much earlier stage of the product life cycle. Competition, performance, new technologies, and resource availability are driving the trend to engineered wood products.
Environmental Drivers

Environmental factors originally resulted in the development and use of LVL and I-beams in the United States, as fewer and smaller logs became available for producing lumber. Engineered wood products produce a significantly higher yield from logs, and the products perform much better as construction materials. They also significantly lower the cost of building, and the time required from start to completion of a house.

Engineered wood products are very environmentally friendly. Only a very few species of wood are currently being used for producing timber. Access to old growth forests in North America and native forests in other regions is being restricted, and the development of plantations now offers many opportunities to grow “pulpwood” size trees in significantly less time than it takes to grow conventional size trees. The new engineering technologies now available permit the use of a much wider range of fibre from small diameter species, from managed timber and from plantations.
While LVL was developed in the early 1970’s, and glulam decades earlier, the restrictions on old growth forests in the early 1990’s in the United States triggered the widespread use of LVL and I-joists in North America. The worldwide trend to restrictions on old growth forests, and hardwood native forests will result in a rapid increase in the use of these products in the future.

A wide range of countries, mainly for environmental reasons, have increasingly restricted access to non plantation timber resources.

In Canada, restricted access to old growth forests in British Columbia has resulted in a shift to smaller logs in the interior and Alberta. There have also been restrictions to hardwood resources in eastern provinces.

In South America, there is pressure to limit harvesting of rain forest logs, which are being replaced with plantation grown softwood in Chile and eucalypt in Brazil.

China, which has a limited resource, is subject to major restrictions on harvesting and wood use. Much of its wood supply now comes from Russia, which itself has infrastructure problems that constrain the harvestable resource.

Malaysia and Indonesia are both rapidly depleting their tropical hardwood resource, and severe restrictions have been placed on illegal logging of tropical hardwood.

In Australia, the logging of native forests has been increasingly restricted over the past twenty years, culminating in the RFA agreements, and the development of softwood and hardwood plantations.
The legislation to ban log exports from public lands was introduced in 1990 in the United States. It was intended to protect the spotted owl, to limit logging in federal government owned lands, and to encourage value-added processing. The total log harvest in the Washington and Oregon declined by 50% between 1990 and 1998, and the share of logging from private land now exceeds 78%.

This provided an ideal environment for expanding the use of engineered wood products such as LVL, LSL and I joists. The restrictions in other world regions have also created an environment that is conducive to the widespread use of engineered wood products. This is especially the case in Asia where there is an unusually high level of illegal logging, and where the huge demand for timber products in China has left the region with a chronic shortage of wood fiber.

In the United States, the spotted owl legislation triggered the widespread use of LVL and I joists. Engineered wood products are now beginning to spread to other regions, partly for environmental reasons, and partly because they perform better than solid timber, and provide cost effective building solutions.

**Efficiency Drivers (log yields)**

Engineered wood products offer a significant advantage in terms of log yield. Sawmilling generally yields only 40% to 50% of the log. By comparison log yields for LVL are 52%. OSB, which is used as the web for I joists has a yield of 75%, and strand lumber has a log
yield of 64% to 76%. Engineered wood products therefore allow for a much more efficient use of timber resources.

In North America for example, I beam flooring systems have rapidly replaced conventional floor systems. In the conventional flooring system, it is estimated that five to 6 cubic meters of lumber is used per house. At an annual average construction level of 1.3 to 1.4 million houses, over 8 million cubic meters of wood fiber is used. With the I-joist flooring system, using LVL for the flange, and OSB for the web, there is a 50% saving in wood fiber. This amounts to a saving of 4 million cubic meters of wood fiber each year. If these systems were used on a global scale, the saving on the world’s resources would be substantial.

**Quality Drivers**

Engineered wood products generally have much better quality characteristics than lumber. In North America, and more recently in Australia, builders who use LVL and I beams prefer them, because they have significantly superior quality characteristics. This is especially the case for larger builders who gain significant construction cost and quality advantages.

I joists have a much more predictable performance than traditional products in terms of strength variability, the dimensions are consistent, they are true and straight, and they
perform with predictable accuracy. They are better able to compete with steel and concrete than solid timber.

I joists are much more consistent performers than solid wood. There is no shrinkage, no crowning, the dimensions are consistent, there are no defects, and there is no warping. Large building companies in particular prefer I joists for flooring systems, although it has been more difficult to convince the smaller builders to use engineered wood products, as they do need to be properly installed.
Population Drivers

There is a significant demographic change underway with the general aging of the population. This is a worldwide phenomenon, and it will affect the labor pool available for construction. The labor saving construction techniques associated with engineered wood products will be favored by the aging of the population.

The over 55 year age group has begun to increase relative to the prime house buying age group of 35 to 55 years, which is declining, and the labor pool available for construction and framing has begun to shrink. Flooring systems save considerably on the labor required for building construction, as does the use of LVL in many other applications. This demographic change will favor the use of engineered wood products in the next two to three decades, as there will be a constraint on the availability of labor for construction.

There are many examples where engineered wood products save on labor and materials. Applications such as garage door headers, flooring systems, carrying beams, and roof truss systems, using engineered wood products all result in considerable labor efficiencies compared to conventional construction methods. One LVL beam for example, can be used in place of two 2x10’s nailed together. A conventional floor requires 133 pieces, compared to an I-joist system of only 80 pieces, 40% less. A conventional carrying beam requires three or four 2x12’s nailed together, compared to one 3.5 inch LVL or Parallam beam. And, an engineered wood roof truss system uses 25% less lumber.
3. **Prospects for Engineered Wood Products**

**Current Markets**

Where are the markets for engineered wood products? The largest markets are in North America, Europe, and North Asia. But the mix of engineered wood products is very different in each of these regions.

North America favors the use of LVL and I joists, which have gained substantial market share over the past decade. The share of glulam is flat and declining.

Europe and North Asia (mainly Japan) have traditionally favored the use of glulam, which is considered in these markets to be a superior product. However, LVL has begun to penetrate the market in Europe and in Japan, and I beams are being used in some parts of Europe, mainly the United Kingdom.

Australia is a mirror image of North America. Very little glulam is used, and I beams and LVL are beginning to penetrate the market. I beams and glulam can be expected to gain a much more significant share of the Australian market over the next decade, and structural LVL and I beams could begin to penetrate Asian markets.
Europe and other Asian countries do not use LVL or I beams as extensively for structural purposes, partly because of construction methods favoring concrete and steel, but as these change, there will be significant opportunities for engineered wood products. China and Vietnam in particular are countries to watch.
I joists are currently produced predominantly in North America. More recently, production facilities have been established in Europe, and in Australia, where production is modest, but growing. They are not yet produced in Asia, which presents a major opportunity for astute investors.

![World I-joist production 2005](image)

In North America there has been enormous growth in the production of I beams and LVL over the past decade. LVL until recently has been used mainly for flanges in I beams. There is now a trend to replacing LVL flanges in I beams with LSL and solid timber. Glulam production by contrast has remained relatively flat.
Glulam is the engineered wood product most traded internationally. Until recently, North American producers exported significant volumes of glulam to Japan. Today, most of the glulam imported by Japan is from Europe. North America also imports small volumes of glulam from Europe. Most of the glulam consumed in Europe is also produced there.

There is also considerable trade in LVL, but I beams have to date been generally consumed in markets where they are produced. This could change in future, as I beams made of one material, such as strand lumber could more easily be transported disassembled, and re-assembled at the point of destination.
Glulam production in Europe has increased very rapidly over the past 15 years. This is not the case for North America or Australia, where production has remained relatively static, while the production of LVL and I beams has expanded rapidly.
Outlook for Engineered Wood Products

Production of engineered wood products can be expected to grow rapidly over the next decade, spreading from North America to Europe, Australia and eventually to Asia. The mix of products will vary by region.

Glulam production will remain static or decline in North America, and will increase rapidly in Europe and North Asia, where it is used extensively. Only small amounts will be produced in Australia.

LVL production will grow in all regions. North America will remain the largest producing region, but LVL production will begin to level off there by 2010, as the product reaches a more mature stage of the product life cycle. In all other regions, LVL production can be expected to expand rapidly, and I would expect that South America will also soon begin to produce LVL.
I-joist production has been concentrated predominantly in North America, and this is likely to remain the case over the next five years. However, production has begun to spread to Australia, and to Europe, and this is likely to accelerate over the next five years.

Generally, engineered wood products offer a significant investment opportunity for the long run. While most of the production currently is focused in North America, Europe,
North Asia and Australia, there is also considerable potential for production in South America, which could well be a surprise new producer over the next five years. So watch South America.