ACIAR FST/2014/065: Development of durable engineered wood products in PNG and Australia

ACIAR FST/2012/092: Enhancing Value Added Wood Processing in PNG

Joint PNG Market Analysis Report

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Authors
Industry Edge

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Market Analysis In Support of ACIAR Projects in PNG:

~ Enhancing Value Added Wood Processing in Papua New Guinea

~ Development of durable engineered wood products in PNG and Australia
**Executive Summary**

Papua New Guinea’s (PNG) domestic market for wood products is small by international measures, but appears to be significantly larger than the formal consumption data suggests. Demand for residential dwellings, and also for other small buildings is growing, providing nascent opportunities for increased utilisation of wood products, including engineered wood products (EWPs).

Enhancing the value adding of PNG’s wood processing sector, including the application of EWPs is very challenging. Globally, competitive value adding requires manufacturing that is at a scale beyond that which is likely to be feasible for PNG, now and into the future.

Manufacturing at scale typically requires a large, consistent and stable supply of wood resources, a range of infrastructure pre-requisites, and large and proximate end markets. These deliver cost-competitiveness that is a necessity for any sustainable manufacturing.

EWPs are a specific group of products that have performance properties that make them useful in engineering applications. They must be manufactured in stable and controlled environments, typically with a mid to high level of automation and at least reasonable technological sophistication. All EWPs are reconstituted wood products, but not all reconstituted wood products are EWPs. Only some plywood can reasonably be considered EWPs, for instance.

In the absence of scale, infrastructure support, end-product cost competitiveness and significant and expensive export market access and development activities, the main markets for PNG’s wood products are domestic and local.

Where export markets can be developed for wood products, they are likely to continue to be in niches and related to unique species and appearance characteristics.

In addition, there are significant financial and regulatory barriers to exporting from PNG, that make regular exports unreliable and less competitive than is the case for many other nations in the region. Perceived sovereign risks on supply and access to wood resources, as well as other regulatory matters, are a significant impediment to attracting manufacturing of a scale required for export markets.

The main export markets are for hardwood logs and to a much lesser extent, sawn hardwood, with China the major recipient of both. There is also plywood export to other Asian markets.

Despite the challenges of manufacturing in PNG, there are smaller and niche markets of existing and potentially greater value for PNG’s wood products, especially associated with ‘appearance’ products. This market assessment
considers that the best opportunity for adding and extracting value from PNG’s wood products is in the integrated supply of affordable, pre or semi-prefabricated residential dwellings to meet PNG’s growing demand for more, and improved, housing.

**Summary of recommendations**

*IndustryEdge* considers that the following items could reasonably be pursued to seek to add value to PNG’s wood products, both domestically and internationally. Further details are provided in section 6.4 of this report.

1. Establishment of a multi-user Central Processing Unit or hub, located within close proximity to the TFTC in Lae

2. Increasing the focus on development of rotary peeled veneer and plywood production for local markets

3. Developing the dwelling component and pre-fabricated housing and other small buildings market

4. Enhancing the development of international markets for PNG’s wood products through the establishment of a market development and access pilot program

5. Improving log transport infrastructure into the CPU, whether by road or by sea

6. Establishing a co-marketing program for domestic applications, focused on treated wood products

7. Map and develop the required skills and capabilities for operation of each development activity and conduct training and skills development through the TFTC
Part 1

Demand drivers and dynamics for PNG wood products

Regardless of the country, its population, level and type of economic activity, income levels and wealth, the demand drivers for wood products are very similar the world over. The drivers are directly linked to the sectors that utilise wood products most extensively.

In most economies, the major end-use sector for wood products is residential dwellings, although it is noted that fuel wood is often the primary end-use for forest fibre/products. However, most fuel wood consumption is estimated because it is typically informal, rather than being part of formal markets and integrated supply chains.

Dwelling needs are so fundamental that in general, growth in the number of dwellings is closely correlated to population change, while expenditure on dwellings is more closely correlated to average income levels.

If population growth and income levels drive dwelling construction on a somewhat predictable and relatively consistent basis, the same can be said for some of the related sectors: joinery, free-standing furniture and garden products (including fences).

However, consistency of demand growth ends there, with other major end-uses of wood products being much less predictable. These include, most significantly, infrastructure and resources projects, the constructions phases of which can utilize very large quantities of specific wood products. In particular, these products include concrete formwork and roughsawn lumber.

1.1 PNG’s domestic demand drivers for wood products

In the context of PNG, the three main drivers of demand for wood products are growth in residential dwellings, industrial construction and energy production.

PNG’s domestic markets are relatively small, constrained by a small population, its decentralised population dispersal and especially, the country’s very low average incomes. This is reflected in the earlier charts showing the country’s apparent consumption of wood products by type from 2000 to 2015. It is again noted that this data excludes the ‘informal’ sector.

Major existing and potential value added markets relate specifically to the built environment, especially dwelling construction.
Notably, mid-decade rises in wood product consumption in PNG are directly attributed by industry participants to the construction component of the resources boom. The elements of boom and bust appear to be present, at least at this cursory level.

1.1.1 Residential dwellings
Successful and systematic application of value added wood products into dwellings in PNG has occurred primarily where there is integration of wood processing, through to construction and supply of housing, especially in the partially or fully pre-fabricated form.

Importantly, domestically produced furniture and joinery is largely included in these wood products volumes, but is not separately measured, other than through defined imports of Particleboard, OSB and MDF deployed primarily into the manufacture of joinery products.

Unfortunately, as the data below shows, the domestic housing market is limited in size, located almost exclusively in Port Moresby (and Lae to a lesser extent) and appears to be hotly contested by competitor non-wood products.

Working from the base of the 2011 Census, and taking into account PNG’s strong population growth trends (a compounding 2.9% per annum from 1980 to 2011), calculated estimates suggest a relatively tight range of annual new dwelling demand across the country, of between 35,542 to 39,630 dwellings per annum in 2016.¹

It should be noted that formal migration data for PNG is only up to date to the June Quarter of 2014², both for permanent migration and short-term migration purposes. The absence of data makes it difficult to assess the extent to which PNG experienced a short-term population ‘spike’ associated with the resources boom.

Data limitations aside, it is nonetheless clear that the resources boom did contribute a rise in short-term migration, with a concomitant rise in short-term dwelling needs. It is noted that these short-term needs are often different from, and distinct to, residential dwelling requirements.

For the sake of conservatism, this market analysis adopts the lower number of new residential dwellings per annum – 35,542 – to provide the base for further analysis. Short-term and employment-related dwelling needs are addressed as an opportunity, later in this analysis.

¹ Sylva Systems, 2017
The 2011 Census analysis indicates that 76.1% or 27,047 of the new residential dwellings are manufactured using ‘traditional’ methods and materials and thus may be considered in the context of the ‘informal’ sector, to the extent to which they are users of wood products. It is likely that they largely deploy informally sourced wood products, as well as re-used, re-purposed and recycled materials.

The remaining 23.9% or 8,495 residential dwellings per annum can be considered to utilize wood products for some or all of their construction. This amounts to approximately one-quarter of all new dwellings constituting the bulk of demand for formally reported wood products in PNG, until the construction phase of the resources boom commenced in 2011.

For the decade prior to 2010, the formal average annual consumption of wood products in PNG was 70,775 m$^3$. Stakeholder advice is that at least 75% of this volume or 53,081 m$^3$ per annum, was deployed into residential dwellings.

This equates to an average of 6.25 m$^3$ of wood products, per new residential dwelling. If all new residential dwellings were built with the same volume of wood products, demand for wood products would rise to a calculated 222,096 m$^3$ per annum, from residential dwellings alone.

It should be noted that this analysis is agnostic as to the specific elements of housing that are supplied by wood products in PNG. It includes structural wood products, as well as furniture, joinery and other appearance products. More detailed analysis is supplied later in this report.

1.1.2 Industrial construction, including sort-term housing

If 75% of PNG’s wood products consumption is for residential dwellings, the remaining 25%, in its various forms, is used in industrial and commercial applications. This includes construction of hotels, lodges and dormitories.

To 2010, the average annual consumption of wood products to industrial and commercial utilisations was therefore 18,131 m$^3$.

This grew rapidly during the construction phase of the energy resources boom, but has just as quickly dissipated, albeit that consumption appears to remain above the levels experienced prior to the construction phase of the boom. This is unsurprising, because the total industrial activity of PNG has increased as a result of the increased resource exploitation activities.

Although direct data is not available, the table below shows growth in PNG’s Gross Domestic Products (GDP) through the period 2012 to 2017 (e). The data

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3 It is notable that average annual wood products consumption has grown significantly in recent years, and for the five years from 2011 to 2015, averaged 164,000 m$^3$ per annum
shows that growth slowed significantly from 2015, which will be impacting industrial construction demand.

**Table 1: PNG's GDP Growth: 2012 – 2017 (e) (%)**

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP (USD billion)</td>
<td>21.3</td>
<td>21.1</td>
<td>21.8</td>
<td>21.2</td>
<td>20.0</td>
<td>21.2</td>
</tr>
<tr>
<td>GDP per capita (USD)</td>
<td>2,967.5</td>
<td>2,878.3</td>
<td>2,898.3</td>
<td>2,746.2</td>
<td>2,528.4</td>
<td>2,613.1</td>
</tr>
<tr>
<td>Real GDP Growth (%)</td>
<td>6.1</td>
<td>4.7</td>
<td>7.4</td>
<td>6.6</td>
<td>2.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

*Source: DFAT*

Thus, in the context of a spike in economic growth, the data that follows is unsurprising. The chart below assumes industrial demand for wood products remains constant at 25% of total consumption over all time periods.

**Chart 1: PNG Industrial Consumption of Wood Products @ 25%: 2000 – 2015 (m³)**

*Source: FAO*

If the 25% proportion is reliable as a baseline, the industrial market has grown and remained relatively strong. According to industry, one reason for this is the rising constraints on exporting, compared with the rising value of wood products in the domestic market. In short, processors appear to have increasingly targeted
the domestic market – unfortunately currently in recession, contributing to the weakness in the exchange rate – against the vagaries and challenges of export markets.

However, it has been noted that anecdotally at least, one reason why the nominally industrial construction element of the consumption of wood products may have remained high post the construction phase of the resources boom is because of heightened developer expectations of further spikes in PNG’s short-term dwelling market.

It was also noted that other events saw short-term labour migration rise through the period 2010 to 2014. These included the Women’s World Cup and the Pacific Games, and extend to include the impending APEC meeting, among other events. Reasons this speculation driven thesis may well be accurate include the experience of higher rental income during the earlier boom, driving some developer behavior, coupled with expectations of a similar short-term migration spike related to the other events described above, but especially associated with the second phase of the LNG project development.

Latest data supports this as a driver for wood products demand in the industrial and commercial sector. In the lead-up to the APEC summit in November 2018, it is expected that almost 2,600 hotel rooms will be available in Port Moresby, developed from a base of just over 2,000 in March 2017 and from a low of just 600 rooms in 2010.4

It should be noted that this development activity is reported based on completion estimations, not commencements, or proposals for development. Additionally, it is expected the additional 5,000 rooms needed for the APEC summit will be supplied by three cruise ships, anchored off Port Moresby.5

1.1.2 (a) Role of EWPs in the industrial construction boom

As demonstrated later in this report that EWPs – especially plywood – are taking up a greater share of PNG’s total wood products consumption. One industry participant advised this was plywood being used as a ‘single-use’ formwork product because the cost of imported formply was prohibitive given the value of the Kina to the US Dollar.

The exchange rate for the last decade is detailed below.

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5 The Economist Intelligence Unit, March 2017
So, as the construction boom proceeded in the commercial and industrial space in PNG, it consumed more EWPs, especially for structural purposes.

1.1.3 Residential v Industrial
The balance of supply between what can clearly be identified as residential dwellings and industrial activity is detailed in the chart below, which shows the apparent consumption of wood products, by major end-use in PNG over two periods. First, from 2000 to 2009 and second, from 2010 to 2015.

This is an attempt to distinguish the construction phase of the energy resources boom, and the other activities described above.
The analysis suggests that if demand supplied by residential dwellings remained static over the period 2011 to 2015, at approximately 53,000 m$^3$ of wood products per annum (the average of the prior decade), the resources boom in 2015 accounted for 61% of the total, up from the industry estimate of an average 25%.

This higher ratio is more likely to have been the case through to perhaps 2014, but subsequently it is as likely that the share of total wood products going to residential dwellings has grown. The second line shows the volume of demand taken up by residential dwellings, over the entire period, if consumption by that sector remains constant at 75% of the total.

It is likely, as one respondent to the draft analysis noted, that there is insufficient data to distinguish the exact proportion of wood products supplied to residential dwellings. However, it is important to note that the 53,000 m$^3$ volume is an average, and the analysis above suggests that by 2014 (the end of the construction phase of the energy resources boom) the volume of wood products...
supplied to residential dwellings totalled close to double the prior identified average.

Extending the theoretical deliberation, we can also observe that during the period of higher demand, from 2010 to 2014, some residential dwelling demand is likely to have gone unmet, having been priced out of the market by the capacity of the energy resources sector to pay for the products it required.

In mid-2014, it was reported by the Oxford Business Group that over the decade to that point, a real-estate boom had been experienced in PNG, associated with the energy resources boom. This was focused on ‘upmarket units’, rents for which doubled over the period 2008 to 2012, resulting in developers’ returns rising sharply ‘in the high-end segment’.6

The report indicates that the market was over-saturated by late 2012 and new residences of this type stalled, partly due to massive increases in construction costs.

This is important information because it indicates that a reasonably significant portion (certainly by value) of the residential dwellings market experienced a boom and subsequent bust, directly linked to the energy resources boom. Advice is that many of these dwellings use timber for appearance purposes and flooring products, but that primary construction was of concrete, especially in the apartment sector.

The implication is that locally produced sawn wood products played only a limited role in this element of any residential dwelling boom.

Imports of plywood and sawn softwood products rose during that period, as set out in Section 2.3 of this analysis. It is relevant to note that those are the complementary products typically used for concrete formwork and it can be anticipated that is the primary purpose to which each was deployed, noting that they will have been more expensive than any domestically produced alternative, should one have existed.

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1.1.3 Energy

Energy sourced from the combustion (generally) of forest fibre/products, or other biological mass, is known as bio-energy. In general, bio-energy can be either thermal (heat) or electrical (power). Forestry and wood products businesses have long used residual biomass from their operations to supply both heat and power.

As described earlier, we note that this is distinct from fuel wood, which may in fact be the primary end-use of forest fibre/products, with the vast bulk almost
inevitably being sourced ‘informally’ or at least, without reference to an integrated supply chain.

In PNG, total energy demand and production are unclear, but driven by population and incomes growth, there is little doubt that energy consumption is growing. Additionally, in many cases, especially in small and isolated communities, energy (electricity) is supplied almost entirely by diesel fuel generators. These are expensive to operate and in some cases, ignore available natural resources, including residual biomass, suitable for small-scale energy generation.

1.1.4 Importance of residues to adding value

For these reasons, the market for residues from wood processing is important. Industrially, in PNG, very little wood is harvested with the intent of creating energy, for instance. Additionally, none appears to be harvested to create woodchips that could be used in pulp and paper mills, or used to create energy. That is, all of the residues are created as an ‘arising’ from the primary purpose of the harvest.

Unfortunately, the volume of residues created from PNG’s formal wood resources is unclear. The measure based on the reported perception of recovered saleable wood product volumes does not deliver a satisfactory output because it indicates that log supply totalled 282,751 m$^3$ in 2015, significantly less than the formal assessment that a total of 441,000 m$^3$ of logs was supplied for the year.

It is important to state that there are significant residues that are not recovered from the forest or plantation, generally for economic reasons. At the point of harvest, an as yet unmeasured volume of wood, not all of it ‘residues’ remains in situ. This can include wood that may be suitable for small piece processing, including for some of the lighter-weight EWPs discussed later in this analysis. This may be an opportunity for further development within the sector.

1.1.4 (a) Residues calculation based on perceived recovery rates

In this calculation, the estimate of the volume of residues produced from formal wood products manufacturing in PNG in 2015 has been derived by utilising perceived and expressed recovery rates for each of the major product groupings. The calculated estimate is that approximately 110,000 m$^3$ of wood residues were created in 2015, as shown in the table below.

The calculation takes the wood products reported as manufactured in PNG, then applies the recovery rates reported by industry to determine the log volume and the nominal residue proportion and volume.
Table 2: PNG Recovery & Residue Volumes by Recovery Rate from Logs: 2015 (m³)

<table>
<thead>
<tr>
<th>Wood Product</th>
<th>Roundwood (m³)</th>
<th>Recovery %</th>
<th>Production (m³)</th>
<th>Residue %</th>
<th>Residue (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn hardwood</td>
<td>116,981</td>
<td>53%</td>
<td>62,000</td>
<td>47%</td>
<td>54,981</td>
</tr>
<tr>
<td>Sawn softwood</td>
<td>37,736</td>
<td>53%</td>
<td>20,000</td>
<td>47%</td>
<td>17,736</td>
</tr>
<tr>
<td>Veneer</td>
<td>96,923</td>
<td>65%</td>
<td>63,000</td>
<td>35%</td>
<td>33,923</td>
</tr>
<tr>
<td>Plywood</td>
<td>31,111</td>
<td>90%</td>
<td>28,000</td>
<td>10%</td>
<td>3,111</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>282,751</strong></td>
<td></td>
<td><strong>173,000</strong></td>
<td></td>
<td><strong>109,751</strong></td>
</tr>
</tbody>
</table>

Source: FAO, PNGFA, IndustryEdge

1.1.4 (b) Residues calculation based on log supply volumes

In this second calculation, the estimate of the volume of residues produced from formal wood products manufacturing in PNG in 2015, utilizing the formally reported log supply volumes. The calculated estimate is that approximately 265,000 m³ of wood residues were created in 2015, as shown in the table below.

The calculation takes the Roundwood supply volume and calculates the recovery rate, residue proportion and residue volume, with the finished product production held constant.

Table 3: PNG Recovery & Residue Volumes & Rates by Log Supply Volumes: 2015 (m³)

<table>
<thead>
<tr>
<th>Wood Product</th>
<th>Roundwood (m³)</th>
<th>Recovery %</th>
<th>Production (m³)</th>
<th>Residue %</th>
<th>Residue (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn hardwood</td>
<td>248,000</td>
<td>25%</td>
<td>62,000</td>
<td>75%</td>
<td>186,000</td>
</tr>
<tr>
<td>Sawn softwood</td>
<td>40,000</td>
<td>50%</td>
<td>20,000</td>
<td>50%</td>
<td>20,000</td>
</tr>
<tr>
<td>Veneer</td>
<td>114,545</td>
<td>55%</td>
<td>63,000</td>
<td>45%</td>
<td>51,545</td>
</tr>
<tr>
<td>Plywood</td>
<td>35,000</td>
<td>80%</td>
<td>28,000</td>
<td>20%</td>
<td>7,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>282,751</strong></td>
<td></td>
<td><strong>173,000</strong></td>
<td></td>
<td><strong>264,545</strong></td>
</tr>
</tbody>
</table>

Source: FAO, PNGFA, IndustryEdge
The two methods to calculate an estimate of available residues are calculated with each of the two different datasets as the base. Inevitably they are different, but here, they are widely different. We note that as residue utilisation is generally a localised matter (especially for energy creation and small-scale wood processing), assessments of available residues need to be conducted at a detailed local level, rather than at a derived and aggregated national level.

1.1.4 (c)  **Implied value of PNG’s residual wood resources**

The international benchmark price for wood residues can be assumed to be the average woodchip export price. In 2015, the global average price of hardwood chips was approximately USDFOB130/bdmt. The table below provides an analysis of the volume and value of PNG’s residual wood resources, in 2015, based on the two calculations provided earlier.

<table>
<thead>
<tr>
<th></th>
<th>Option (a) ‘Perceived Recovery Rates’</th>
<th>Option (b) ‘Log Supply’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residue Volume (bdmt)</td>
<td>54,876</td>
<td>132,273</td>
</tr>
<tr>
<td>Ave. Woodchip Price (USDFOB/t)</td>
<td>130.00</td>
<td>130.00</td>
</tr>
<tr>
<td>Total Annual Value (USD)</td>
<td>USD7.133M</td>
<td>USD17.195M</td>
</tr>
</tbody>
</table>

*Source: FAO, PNGFA, IndustryEdge*

Regardless of which measure is preferred and accurate (or closest to accurate), the economic value of PNG’s wood residues is not insignificant, and represents an opportunity.

However, industry advises that the residual resource is not aggregated, in part because it is dispersed across the country, and is largely un-utilised, although it is evident that some is deployed to create thermal energy for wood drying.

Additionally, and encouragingly, in Lae, one wood products company is manufacturing 40 megawatts of electricity from biomass and reportedly plans to expand that to 80 megawatts in the future.

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7 Bone dry metric tonne (bdmt), measures the fibre content of wood. This analysis assumes that all species are equal and that two tonnes of wood constitute one bdmt, meaning it is implied that wood contains 50% fibre
Reports indicate that as a disposal strategy, some producers allow local residents to extract material from their residues stockpiles, for use as fuelwood.

The chart below, showing exports of the various forms of residues, is provided merely for the sake of completeness, as it demonstrates exports of residues have never exceeded a miniscule 700 m³ per annum.

**Chart 4: Woodchip, Particle, Woodfuel and Wood Residue Exports: 2008 – 2015 (m³)**

![Chart 4: Woodchip, Particle, Woodfuel and Wood Residue Exports: 2008 – 2015 (m³)](chart_image)

*Source: FAO*

### 1.2 International demand drivers for wood products

Demand drivers in Asia and indeed, globally, are little different from one region to the next. They vary in accordance with the conditions of each economy, but in terms of the hierarchy of demand drivers, residential dwellings have primacy, followed by industrial and energy needs.

Given the growth in Asian populations, and their rising living standards, there is little point in general terms, in looking past the immediate region for the future drivers of potential export demand for PNG’s wood products.

#### 1.2.1 Asian population growth and middle-class incomes

The figure below shows forecast Asian population growth for key countries, through to 2050.
In this chart, although it looks small relative to the existing population, we can observe that growth in Asian populations through to 2050 will approximate 400 million additional people. Perhaps more importantly, even as the Chinese population plateaus and eventually commences its long and inexorable slide, other nations – most notably India – experience population expansions that more than compensate.

Moreover, as the chart below shows, Asia’s share of middle-class incomes will grow dramatically through to 2050, again with India driving the emerging dominance.
As Asia’s population grows and its living standards improve, the region’s demand for improved housing, better furnishings, more infrastructure and for energy resources is likely to prove insatiable.

The ability of PNG to supply Asian markets with wood products is likely to be less about demand and more about supply side considerations. Two of the most significant of these will be the capacity to supply a commercial volume, at a competitive price.

Both of these fundamental criteria are challenging for a small producing nation like PNG. According to industry sources, PNG is generally not competitive with major Asian producers of transformed wood products (sawnwood, veneers and plywood). There are several drivers for this competitive position, some of which operate in conjunction with one another:

- Sub-scale manufacturing
- Inadequate and inconsistent log supply
- Poor logistics and transport infrastructure between regions
- Complicated and expensive export processes.
1.2.2 Demand drives log exports
The result, in part, of the constraints outlined above, is that historically, currently, and likely into the future, primary demand for wood and wood products from PNG is for hardwood logs, exported to major Asian producer nations. In 2016, SGS reported that the vast majority of exported logs, (89.6%) were saw and veneer logs. This is displayed in the chart below.

Chart 7: PNG Log Exports by Grade: 2015 (m³)

![Chart showing hardwood log exports from 2000 to 2015](image)

*Source: SGS*

It is instructive that near 90% of hardwood log exports are targeted to saw and veneer log outcomes because it implies that the exporter considers that the transformation of the logs into sawnwood, veneer and plywood products is more economically efficient somewhere other than PNG.

This is not a single year trend. It is a long-term strategy and notably, one in which the major exporter group is also the major domestic processor of logs and manufacturer of wood products.

The chart below shows hardwood log exports from 2000 to 2015.
SGS also reports that hardwood log export volumes and destinations were similar to those for 2015 and prior years.

Set out below is saw and veneer log exports by country for 2016.
1.2.3 Hardwood log export prices are globally comparable
PNG’s hardwood log exports are an integrated element of the global trade in logs. As the data below indicates, average prices for PNG’s hardwood log exports are consistent with those from Australia, into the main Chinese market.

In 2016, Australia’s hardwood log exports totalled 355,100 m³, of which 97.7% was shipped to China. The average price of the supplies to China, the only relevant supply, was USDFOB127.75/m³ 8. By comparison, the average price reported for PNG’s hardwood saw and veneer log exports to China was USDFOB96.32/m³ 9.

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8 Australian Bureau of Statistics (ABS), AHECC 4403.99.00
The PNG average price is within a range of comparability with the Australian average price, noting that even exactly the same products sold from one origin are rarely the same price as those from another origin.

Interviews suggest that the relatively high costs of sea freight and export from PNG mean that the sale price of logs is marginally lower, to ensure the delivered cost of logs (inclusive of the freight component) is competitive.

1.2.4 Hardwood logs account for 99% of PNG’s total harvest
To place the 2016 export data into context, in 2015, almost 90% of PNG’s hardwood log harvest was exported, but the hardwood log harvest was 99% of the total harvest, with just 40,000 m³ of reported softwood logs harvested. Of a formally reported total harvest of 3,961,000 m³, more than 3,500,000 m³ were exported. The chart below shows PNG’s apparent consumption of hardwood logs.

Chart 10: PNG Apparent Consumption of Hardwood Logs: 2000 – 2015 (m³)

Source: FAO

In 2015, the formally reported volume of hardwood logs harvested in PNG that remained in the country for wood processing was 401,000 m³. This was
supplemented by a further 39,922 m$^3$ of softwood logs, due to there being virtually no softwood log exports.

The 2015-16 Biennial Review of the International Tropical Timber Organisation (ITTO) reported that Papua New Guinea and the Solomon Islands together accounted for 54% of all of China’s tropical log imports.$^{10}$ It also reported that PNG was the largest exporter of tropical timbers in the 2015 financial year, with exports totaling 3.6 million m$^3$, over 87% of which were delivered to China. This very closely approximates the FAO data described in the chart above.

Importantly, the ITTO review emphasizes that external market trends appear to be the primary driver of PNG’s hardwood log export volumes:

“PNG’s log export trends have therefore followed market conditions in China, declining slightly in 2015 as the Chinese economy slowed, and picking up in 2016, when PNG tropical log exports totalled 3.8 million m$^3$.”

However the report also notes that exports from PNG and the Solomon Islands may have been encouraged by log export bans imposed by major exporters outside the Asia Pacific region.

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$^{10}$ ITTO, Biennial review and assessment of the world timber situation 2015-2016, 2016
Part 2

Apparent Consumption of Wood Products in PNG

In 2015, PNG’s formal apparent consumption of all wood products was a very small 137,809 m$^3$, having grown an average 13.4% per annum since 2000.

However, as the chart below shows, the growth commenced in approximately 2005 and was both steep and consistent through to a peak of 236,321 m$^3$ in 2011. In the four subsequent years to 2015 – and reportedly also in 2016 – apparent consumption declined, but remains significantly higher than in previous periods.

Made up of three components (production, less exports, plus imports), apparent consumption is generally considered to be a reliable, albeit imprecise measure of domestic demand.

In PNG’s context, the limitation of the apparent consumption function is that it does not make any assessment of the significant informal wood products sector, especially in regional areas. A further limitation may be that in some years, it is clear that production has been estimated.

Regardless of the limitations of this data, it is assessed consistently. Moreover, field investigations indicate there is no better data series.

Relevantly, the major producer – the Rimbunan Hijau Group – considered that the reported volumes were broadly within range, although they noted that the informal sector was very difficult to assess.
In later parts of this analysis, PNG’s apparent consumption of specific wood products will be detailed. The charts below detail each of the elements of demand, for all wood products, over the period 2000 to 2015.

2.1 **PNG’s Production of Wood Products**

PNG’s production of wood products is formally reported as limited to four main product groupings.

These are listed below, along with reported production volumes, with some further distinction provided by *IndustryEdge* in respect of estimated Veneer production.
Table 5: PNG Production of Wood Products by Main Grade: 2015 (m³ & %)

<table>
<thead>
<tr>
<th>Wood Product</th>
<th>2015 Production (m³)</th>
<th>Ave. % Change 2000-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Hardwood</td>
<td>62,000</td>
<td>+3.0</td>
</tr>
<tr>
<td>Sawn Softwood</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Veneer</td>
<td>63,000</td>
<td>+7.9</td>
</tr>
<tr>
<td>~ Rotary Peeled (est)</td>
<td>(62,500)</td>
<td>-</td>
</tr>
<tr>
<td>~ Sliced (est)</td>
<td>(500)</td>
<td>-</td>
</tr>
<tr>
<td>Plywood</td>
<td>28,000</td>
<td>+7.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>173,000</strong></td>
<td><strong>+6.3</strong></td>
</tr>
</tbody>
</table>

*Source: FAO & IndustryEdge*

Growth in production of veneer and plywood over the period, despite remaining small in aggregate volume, has grown solidly at almost 8% per annum.

The chart below shows aggregate production of wood products by grade, for each year since 2000.

**Chart 12: PNG Production of Wood Products by Grade: 2000 – 2015 (m³)**

*Source: FAO*
Based on the 401,000 m$^3$ of logs consumed in PNG in 2015, the 173,000 m$^3$ of aggregate wood products manufacturing means the average recovery rate was 43.2%.

### 2.2 PNG’s Exports of Wood Products

Although variable over time, PNG’s exports of wood products appear to have altered through to 2015, with less veneer being exported, with the more value added plywood showing increased exports over time.

In 2015, exports accounted for 24.7% of production, by volume. Perhaps most notably, while production of plywood has increased an average 7.9% per annum over 15 years, exports of the same product have declined an average 2.9% per annum.

Put another way, in 2000, exports of plywood accounted for more than 75% of production. By 2015, that proportion had declined to just more than 16%.

Still small in volume terms, PNG’s consumption of EWPs is growing.

PNG’s exports of wood products in 2015, and the average annual rate of change since 2000, are detailed below.

#### Table 6: PNG Exports of Wood Products by Main Grade: 2015 (m$^3$ & %)

<table>
<thead>
<tr>
<th>Wood Product</th>
<th>2015 Exports (m$^3$)</th>
<th>Ave. % Change 2000-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Hardwood</td>
<td>33,866</td>
<td>-0.6</td>
</tr>
<tr>
<td>Sawn Softwood</td>
<td>410</td>
<td>-7.4</td>
</tr>
<tr>
<td>Veneer</td>
<td>3,897</td>
<td>-1.6</td>
</tr>
<tr>
<td>Plywood</td>
<td>4,483</td>
<td>-2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42,656</strong></td>
<td><strong>-1.1</strong></td>
</tr>
</tbody>
</table>

*Source: FAO*

PNG’s exports of wood products are explored further in Part 4 of this market analysis.
2.3 PNG’s Imports of Wood Products

Unsurprisingly, PNG imports very little of the wood products it consumes. Although its supplies of some EWPs (Particleboard for example) are fully imported, their volumes – set out in Part 5 – are very small.

However, if we are to glean anything from this data, it is that imports of plywood – here assumed by industry to be primarily for concrete formwork – grew through the period described as the resources construction boom, but are yet to (and may not) return to pre-boom levels.

PNG’s imports of wood products for 2015, and their average growth rate for the period since 2000 are detailed below.
Table 7: PNG Imports of Wood Products by Main Grade: 2015 (m³ & %)

<table>
<thead>
<tr>
<th>Wood Product</th>
<th>2015 Imports (m³)</th>
<th>Ave. % Change 2000-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Hardwood</td>
<td>123</td>
<td>-</td>
</tr>
<tr>
<td>Sawn Softwood</td>
<td>2,970</td>
<td>-</td>
</tr>
<tr>
<td>Veneer</td>
<td>177</td>
<td>-</td>
</tr>
<tr>
<td>Plywood</td>
<td>3,258</td>
<td>+15.0</td>
</tr>
<tr>
<td>Other EWPs</td>
<td>937</td>
<td>-3.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,465</strong></td>
<td><strong>+9.2</strong></td>
</tr>
</tbody>
</table>

*Source: FAO*

Chart 14: PNG’s Imports of Wood Products: 2000 – 2015 (m³)

*Source: FAO*

2.4 End-Use demand for wood products in PNG

Based on the small amount of available data, field interviews and other observations, an assessment of end-use demand for PNG wood products has been calculated for 2015.
2.4.1 Primary end-uses
As outlined earlier, primary demand is for new residential dwellings (and products used in dwellings such as joinery and furniture), supplemented by industrial utilisations and energy needs.

The diagram (Figure 1) on the following page sets out the apparent and estimated material flows from log production to the previously identified primary end-uses in PNG.
2.4.2 Specific end-use applications

Although not entirely apparent and completely transparent, the specific end-use applications to which PNG’s wood product consumption is applied is able to be discerned from some limited data.

As discussed earlier, the significant volume of wood products consumed in PNG are consistently deployed into Housing, Joinery & Furniture and Infrastructure & Commercial activities. The different types of wood products consumed in PNG and their Major End-Use Markets are set out in Section 4.3 of this analysis.

The table (Table 8) on the following page presents some of the same data, but does so focusing on the major End-Use Markets and specific products understood to be supplied, by provenance (domestic or import). The very small volumes of imports in 2015 are allocated specifically to end-use applications, where they are known or have been identified by, for example, Australian exporters.

Within the range of sawnwood products imported to PNG, IndustryEdge is advised by Australian exporters, that their supply is primarily structural timbers (sawn softwood), that have been assessed and graded to engineering standards and are capable of withstanding forces described in Australian building codes. These are reportedly supplied under criteria often established by agencies and organisations involved in constructing new dwellings and commercial buildings. Imported plywood is almost all construction formply.
<table>
<thead>
<tr>
<th>Wood Product</th>
<th>Est. Annual Market (m³)</th>
<th>Housing</th>
<th>Infrastructure &amp; Commercial</th>
<th>Furniture &amp; Joinery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Domestic</td>
<td>Imported</td>
<td>Domestic</td>
</tr>
<tr>
<td>Sawn Hardwood</td>
<td>62,000</td>
<td>Structural</td>
<td>-</td>
<td>Structural</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>Appearance</td>
</tr>
<tr>
<td>Sawn Softwood</td>
<td>20,000</td>
<td>Structural</td>
<td>2,376 m³</td>
<td>Structural</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>Appearance</td>
</tr>
<tr>
<td>Sliced/solid Veneer</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Plywood – Non-Structural</td>
<td>23,800</td>
<td>Flooring, cladding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Plywood – Structural</td>
<td>4,200</td>
<td>Formwork, bracing</td>
<td>-</td>
<td>Formwork</td>
</tr>
<tr>
<td>Medium Density Fibreboard *</td>
<td>937</td>
<td>-</td>
<td>&lt; 100 m³ (bracing)</td>
<td>-</td>
</tr>
<tr>
<td>Hardboard *</td>
<td>-</td>
<td>-</td>
<td>&lt; 50 m³ (cladding)</td>
<td>-</td>
</tr>
<tr>
<td>Oriented Strand Board *</td>
<td>-</td>
<td>-</td>
<td>&lt; 50 m³ (bracing)</td>
<td>-</td>
</tr>
<tr>
<td>Particleboard *</td>
<td>-</td>
<td>-</td>
<td>&lt; 200 m³ (flooring)</td>
<td>-</td>
</tr>
</tbody>
</table>

* Imports of these products make up the entirety of the PNG domestic market and are, according to importers, regularly used interchangeably. The market size assessment was derived, from information provided by a long-term Australian exporter.
Part 3

International demand for wood products

Global demand for wood products is difficult to assess, especially because of the prevalence of informal extraction of wood for a variety of purposes discussed earlier in this report.

The FAO provides, in our estimation, the most reliable global assessment of demand for wood products.

3.1 Global wood products demand and drivers

Global demand for wood products has grown continuously and nearly consistently since the global financial crisis, as the chart below shows. At 897.1 million m³ in 2016, consumption growth has averaged 1.9% per annum over the decade, but a far faster 4.5% per annum since the middle of the decade in 2011. Importantly, this rate of growth is close to double the average rate of global economic growth since 2011.

Chart 15: Global Wood Products Apparent Consumption: 2006 – 2016 (Mm³)
The chart below shows total Asian demand for wood products from 2000 to 2016.

**Chart 16: Asian Wood Products Apparent Consumption: 2006 – 2016 (Mm³)**

At 423.6 million m³ in 2016, Asian wood products demand is high and very significant, having grown at an average annual rate of 7.1% over the decade. This growth rate of more than double the rate of global economic growth over the period was a marginally more modest 6.7% per annum over the five years since 2011.

Despite the apparent consistency in growth, there are two periods of note in the decade. At the commencement of the decade, growth in demand was muted, largely due to the onset and effects of the global financial crisis. More recently, reported apparent consumption has grown at a relatively slower rate (2.6% from 2015 to 2016 for instance).

The more recent softening in growth in apparent consumption is a little more difficult to attribute than the GFC period. However, it has been observed that prices for primary wood resources (logs and woodchips) and important intermediate products (pulp) have been rising since early 2016. Most recently, in 2017, the prices of each of these products have increased markedly, as has the average price of recovered paper.
The emerging thesis, and currently the only proposition supported by the evidence, is that prices are increasing because growth in supply is struggling to meet growth in demand for wood products and for wood fibre in general.

This is in part supported by continuing – and more rapid – global economic growth, which implies at least a continuation of prior demand growth, if not expressly implying an expectation of rising demand growth.

**Other indicators of rising demand**

As the chart below shows, chemical pulp prices in China have risen sharply over 2017, with particular emphasis on growth in the price of Bleached Eucalypt Kraft (BEK) pulp – essentially the premium hardwood pulp. As can be observed, prices are only marginally lower than their peak of late 2011 to early 2012. The lower green line should also be noted. This is the ‘spread’ or differential between the two pulps. The narrowing of the spread in recent years is indicative of relatively higher hardwood pulp prices, arising because of increasing shortages of hardwood pulp.

**Chart 17: China Chemical Pulp Prices by Grade and Spread: Jan ’06 – Oct ’17 (USD/t)**

Source: Hawkins Wright, Brian McClay & Associates & IndustryEdge
The chart below shows clear growth in the price of Australia’s recovered paper exports since 2013. Recovered paper is a secondary fibre source. Generally, demand for it is subsidiary to that of virgin wood pulp, and its price is normally constrained accordingly.

Chart 18: Australian Recovered Fibre Exports by Grade: Jan ’13 – Sep ’17 (AUDFOB/t)

Source: ABS

Rising pulp prices, followed by sharp increases in secondary fibre resources, point to the value (and price) of fibre rising globally.

The implication of this geo-market data is that it points to rising scarcity of supply of wood fibre. As demand continues to rise – at least in line with population growth, leave aside the impact on demand of rising living standards in Asia – supply will continue to be under pressure. Under this near-certain scenario, prices will rise, making all wood fibre more valuable.

3.1.1 Global demand for EWPs
Because of the drivers described earlier, demand for EWPs is growing globally, and in most significant markets.
While population growth and improving living standards are fundamental drivers, EWPs may be uniquely placed to supply the housing, industrial construction materials and energy needs of the future. Land use constraints, exacerbated by a rapidly expanding population, demand ever more efficient resource utilisation.

Recovery to reconstituted wood products, including EWPs, is generally higher than for sawnwood, maximizing resource utilisation. In many cases, the performance characteristics of EWPs are an enhancement on the same volume of wood used to create sawnwood products.

Operationally, EWPs are consistent and generally light-weight, making them suitable for both single-build construction and manufactured construction.

EWPs are efficient users of wood resources and lend themselves to highly efficient and generally faster construction. These features are recognized in the decade’s average consumption growth rate of 4.0%, and a very strong 7.6% since the middle of the decade in 2011. The chart below provides the details.

**Chart 19: Global Apparent Consumption of EWPs: 2006 – 2016 (Mm³)**

![Chart 19](chart19.png)

*Source: FAO*

Of the different EWPs, the three most significant by consumption are Plywood (160.7 Mm³ in 2016, or 37.2% of the total), Particleboard & OSB (120.5 Mm³ in 2016 or 27.9% of the total) and MDF/HDF (98.5 Mm³ in 2016 or 22.8% of the total).
The relative growth rates for these major EWPs are shown below, for each of the last decade, five and one years.

Table 9: Rates of Consumption Growth – Major EWPs: 10, 5 & 1 Year (%)

<table>
<thead>
<tr>
<th>EWP</th>
<th>10 Year Ave.</th>
<th>5 Year Ave.</th>
<th>1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plywood</td>
<td>6.4%</td>
<td>7.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Particleboard/OSB</td>
<td>0.9%</td>
<td>4.3%</td>
<td>5.6%</td>
</tr>
<tr>
<td>MDF/HDF</td>
<td>6.7%</td>
<td>5.0%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

*Source: FAO & IndustryEdge*

This simple comparison shows that the rates of growth of the major EWP formats are variable over time, but over the mid-term (5 years), they are relatively consistent, at high levels.

3.1.2 Drivers of global wood products demand

There is little doubt that as with all products, global economic conditions are fundamental to demand for wood products. While this is an underlying reality, it is more useful to consider the specific factors that drive global consumption of wood products.

**Population growth**

The largest single factor driving global demand for wood products is the rate of population growth. Global populations, on even the most conservative estimates, are estimated to reach 9.8 billion persons by 2050, with growth concentrated in Asia (led by India, China, Pakistan and Indonesia) and Africa (led by Nigeria, the Democratic Republic of the Congo, Ethiopia, the United Republic of Tanzania and Uganda). Of developed countries, only the United States of America is in the top ten countries for population growth to 2050.\(^{11}\)

**Housing, residential and other buildings**

In many countries, the major driver for wood products demand is domestic dwellings and related buildings. This is reflected in the production of sawn wood and wood panels, both of which are largely consumed in building construction.

\(^{11}\) UN Department of Economic & Social Affairs, 2017, *World Population Prospects: The 2017 Revision*
Global production of sawnwood totalled a reported 452 million m³ in 2015, up 2.9% on the prior year. Asia-Pacific region production was 134 million m³, accounting for 30% of global production in 2015.\footnote{12}{FAO, 2015 Global Forest Products Facts and Figures}

In 2015, global production of wood panels (plywood, particleboard, MDF and their variants) totalled 399 million m³, up 3% on the prior year. The Asia-Pacific region accounted for 63% of this production, totalling 250 million m³. China is the world’s largest producers of wood panels.\footnote{13}{ibid}

**Fuelwood**

In some countries, demand for fuel wood is informally considered to be higher than demand driven by housing needs. In 2015, global wood fuel production totalled 1.866 million m³, having risen just 1% since 2011. According to the FAO’s assessments, in 2015, wood fuel production accounted for 51% of global roundwood production.\footnote{14}{ibid}

Regionally, and underscoring the socio-economic drivers for the use of wood as fuel, in Africa, 90% of roundwood was used for fuel in 2015, but just 20% in North America. In the Asia-Pacific region, fuel accounted for 63% of all roundwood.

It should be noted that this data is exclusive of the surging wood pellets market, which despite its growth in recent years, remains in its infancy.

In this demand context, given a growing population, a defined landmass being required to deliver ever more resources to that population, and the associated sustainability concerns about many finite resources, global demand for wood products is expected to grow inevitably. Parenthetically, and as discussed elsewhere in this analysis, since early 2017, a range of leading pricing indicators for wood products – most especially wood pulp, an intermediate product used primarily in the manufacture of paper and paperboard – have been rising, as global economic growth returns to stable growth after close to a decade of languishing. The driver of prices growth has been a sustained (although still in its infancy) rise in demand for wood products.
3.2 Asian wood products demand and relevant criteria

Asia is therefore the critical region for consideration of PNG’s international markets. The chart below sets out total Asian demand for wood products from 2000 to 2016.

**Chart 20: Asian Apparent Consumption of Wood Products: 2006 – 2016 (Mm³)**

![Chart showing Asian Apparent Consumption of Wood Products: 2006 – 2016](chart.png)

*Source: FAO*

*Note: excludes all roundwood, woodchip and fuel wood and pulp, paper and paper products*

The chart shows both strong growth in apparent consumption, driven largely by improving production, and relatively low trade volumes, over all periods.

In 2016, the FAO reports Asian region consumed 423.6 million m³ of wood products, having grown at an annual average rate of 7.1% over the decade since 2006. Production grew at an annual average rate of 6.9%, while imports rose 4.8% over the same period. Imports totalling 83.8 million m³ in 2016 accounted for just less than 20% of total regional consumption.

The chart below shows Asian region production of wood products over the same decade, by main type.
Against the backdrop of average consumption rising 7.1% per annum, fuelled largely by growing regional production, the major contributor to rising production has been plywood, and to a lesser extent MDF/HDF.

It is relevant to note that these products – the plywood being particularly relevant – are primarily construction materials, and thus are produced almost entirely from rotary peeled veneers, as distinct from sliced or appearance grade veneers.

In 2016, plywood production totalled 130.9 million m\(^3\), having grown at an average rate of 9.4% per annum since 2006. Plywood accounted for almost 35% of Asian region production in 2016.

Sawn hardwood production is the second largest volume of production each year. In 2016, production totalled 73.2 million m\(^3\), having grown 5.7% per annum over the decade.

Within Asia, imports make up the remainder of the consumption function. As the chart below shows, imports are dominated by sawn softwood, most of which is imported from North America and Europe.
Although relatively small, at 2.5 million m³ in 2016, imports of veneer are significant, including an unknown (but inevitably small) proportion of which is sliced and appearance grade veneers. Veneer imports have grown an average 9.9% per annum over the decade to 2016. This is, at a volumetric level, an opportunity for supply from PNG.

At 14.6 million m³, Asian imports of sawn hardwood are also substantial, having grown at a metronomic 3.8% per annum over the decade. Unfortunately, the FAO data is unrefined as to grades, piece sizes of other data that would allow for more detailed regional analysis.

However, value from relatively small volumes of sawn hardwood production from PNG is likely to be optimized for smaller piece sizes, such as those used in manufacturing solid timber.

It is likely that it is these two grades for which there is greatest opportunity for PNG’s wood products within Asia, recognizing that the region’s deficits are met by imports.
3.2.1 Forest certification requirements
The rise of global forest certification schemes as a market factor has been substantial and is continuing to expand its influence, including within Asia.

Openly traded markets the world over should be expected to require certification of wood products by either the Program for Endorsement of Forest Certification schemes (PEFC) or the Forest Stewardship Council (FSC).

Within Asia, expectations are different between countries. More developed markets – Japan is the best example – require their wood products to be certified in virtually all instances. Conversely, less developed countries are far less likely to be systemically interested in fibre certification.

The situation may be different for closed markets, where wood products are transferred within the operations of the same company or group of companies in different countries. In those situations, especially where the wood product is used industrially (as construction materials like formply for example), the requirement for third-party certification may not be required.

Ultimately, the requirement for certification depends upon its end-use application. For instance, if the same plywood is to be used as formwork in Asia, it is unlikely to require certification, but if it is exported to Europe, it may require certification.

It is noted, in the context of supply to Europe, that developments are continuing that aim to provide an over-arching sustainability ‘mark’ that assures buyers that all of a wood product’s inputs are from sustainably managed forests, regardless of their certification scheme.15

It may be assumed that for higher value markets, certification is a supply requirement. Certainly, from a market development standpoint, certification, at least at the chain-of-custody level, should be considered as required.

3.2.2 Australian demand for EWPs
Although distinct in some respects, Australia’s demand for Engineered Wood products is a sub-set of Asian EWP demand.

In total, as the chart below shows, demand for EWPs has grown at an average annual rate of 1.1% since 2006. However, the rate of growth has been double that for MDF (3.2% per annum) and for Plywood, a more modest 1.0% per annum). Particleboard consumption has grown an average of just 0.2% per annum over the same period.

Chart 23: Australian Apparent Consumption of EWPs by Main Grade: 2006 – 2016 (km³)

For comparative purposes, the table below shows Australia’s production of each of these major EWPs for 2006, 2010 and each of 2014 to 2016.

Table 10: Australian Production of Main EWPs: 2006, 2010, 2014-16 (m³)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plywood</td>
<td>544.0</td>
<td>498.9</td>
<td>546.5</td>
<td>614.3</td>
<td>602.1</td>
</tr>
<tr>
<td>Particleboard</td>
<td>1,012.8</td>
<td>972.8</td>
<td>944.3</td>
<td>985.9</td>
<td>1,033.2</td>
</tr>
<tr>
<td>MDF</td>
<td>422.0</td>
<td>476.5</td>
<td>465.5</td>
<td>530.3</td>
<td>577.2</td>
</tr>
<tr>
<td>Total</td>
<td>1,978.8</td>
<td>1,948.2</td>
<td>1,956.3</td>
<td>2,130.5</td>
<td>2,212.5</td>
</tr>
</tbody>
</table>

Source: ABS, EWPAA & IndustryEdge
For the purposes of this analysis, Australia’s consumption of plywood is the most important EWP. The chart below sets out Australia’s consumption of plywood over the last decade.

Apparent Consumption of plywood rose a very modest 1.0% per annum over the decade, well below the average rate of inflation and of total consumption of wood products.

Chart 24: Australian Apparent Consumption of Plywood: 2006 – 2016 (km$^3$)

Production reached 275.5 km$^3$ in 2016, having averaged a decline of 0.6% per annum over the decade. Production peaked in 335.0 km$^3$ in 2008. Imports have grown an average 5.9% per annum over the same period, totalling 336.7 km$^3$ in 2016. Exports, always negligible in aggregate, have grown an average 25.5% per annum over the decade, totalling 35.9 km$^3$ in 2016.

Production, which accounted for 82.3% of consumption in 2016, is dominated by Structural products, followed by Overlaid product, which includes construction formply.

Interior grade plywood production includes a small quantity of plywood manufactured from sliced veneer.

Table 11: Plywood Production by Main Grade: 2006, 2010, 2014 - 2016 (km³)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior</td>
<td>3.0</td>
<td>3.1</td>
<td>2.0</td>
<td>1.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Marine</td>
<td>1.2</td>
<td>1.0</td>
<td>0.4</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Overlaid</td>
<td>47.1</td>
<td>45.8</td>
<td>49.3</td>
<td>47.4</td>
<td>45.2</td>
</tr>
<tr>
<td>Tongue &amp; groove flooring</td>
<td>25.6</td>
<td>21.3</td>
<td>12.0</td>
<td>11.6</td>
<td>10.8</td>
</tr>
<tr>
<td>Structural</td>
<td>197.1</td>
<td>207.5</td>
<td>201.3</td>
<td>197.9</td>
<td>190.2</td>
</tr>
<tr>
<td>Ext. &amp; other commercial</td>
<td>18.8</td>
<td>16.3</td>
<td>30.1</td>
<td>27.7</td>
<td>26.8</td>
</tr>
<tr>
<td>Total</td>
<td>292.8</td>
<td>295.0</td>
<td>295.1</td>
<td>286.7</td>
<td>275.5</td>
</tr>
</tbody>
</table>

Source: EWPAA & IndustryEdge research & estimates

Chart 25: Australian Plywood Production by Grade: 2006 – 2016 (km³)

Source: EWPAA & IndustryEdge research & estimates

**Chart 26: Australian Plywood Imports by Grade: 2006 – 2016 (km³)**

![Chart showing plywood imports by grade from 2006 to 2016.]

*Source: ABS*

**Table 12: Plywood Imports by Main Grade: 2006, 2010, 2014 – 2016 (km³)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior</td>
<td>15.4</td>
<td>11.0</td>
<td>57.6</td>
<td>59.0</td>
<td>80.2</td>
</tr>
<tr>
<td>Structural</td>
<td>67.8</td>
<td>20.9</td>
<td>49.9</td>
<td>59.4</td>
<td>48.9</td>
</tr>
<tr>
<td>Overlaid</td>
<td>30</td>
<td>46.6</td>
<td>68.1</td>
<td>103.1</td>
<td>112.5</td>
</tr>
<tr>
<td>Other</td>
<td>76.2</td>
<td>176.0</td>
<td>83.5</td>
<td>95.1</td>
<td>95.1</td>
</tr>
<tr>
<td>Total</td>
<td>189.4</td>
<td>254.5</td>
<td>259.1</td>
<td>316.6</td>
<td>336.7</td>
</tr>
</tbody>
</table>

Australia’s imports of plywood have grown at an average rate of 5.9% per annum over the decade, fuelled primarily by strong growth in the Overlaid grade (14.1% per annum over the decade). Australia’s imports of plywood are reported in less refined detail than is the case for production. The Overlaid grade of imports includes the majority of construction formply imported to Australia.

The Appearance grade has also show solid growth over the decade (17.9% per annum). It includes plywood made with sliced veneer faces, including of tropical timbers.
Veneer Imports

Plywood is manufactured from veneers, and although it is not possible to determine the volume of consumption of veneers, imports are separately recorded. Veneer imports include both rotary peeled veneers (for instance most if not all of those from New Zealand), as well as sliced and appearance grade veneers.

The chart below shows the details of Australia's veneer imports over the last decade.

Chart 27: Australian Imports of Veneer by Country: 2006 – 2016 (km³)

Over the decade, Australia’s imports of veneers peaked in 2007 at a modest 32.9 km³. They have subsequently declined to total 12.8 km³ in 2016. The decline in imports is largely due to appearance grade veneer products experiencing declining demand, while imports of the finished plywood products have reportedly increased over the same period.

It is noted that supplies from PNG are here included within the ‘Other’ group of countries.

Other than imports from New Zealand, it is widely considered that the majority of imports are of ‘appearance’ grade, including sliced veneers from PNG and other producers of tropical timbers.
Strategic and consistent supply of veneers into Australia represent a small but high value added market development opportunity for supplies from PNG.

3.3  

**Australia and PNG bilateral trade in wood products**

Australia and PNG have enjoyed very little bilateral trade in wood products since 2009. In general, and certainly from an Australian perspective, the trade is negligible in terms of both volume and value, but does provide some pointers as to opportunities for potential expansion, especially of PNG’s imports to Australia.

3.3.1  

**PNG’s exports to Australia**

Other than in 2015, PNG’s imports to Australia have approximated 10,000 m$^3$ of material per annum.

Discussions with Australian importers and wood product companies elicited the following information.

The sawnwood volume is primarily hardwood and is considered to be destined primarily for the furniture and appearance grade market. The term used by one importer was ‘exotic’, implying that the imports are different to species or appearances generally available in Australia.

Plywood imports are the most consistent of PNG’s supplies to Australia, and relatively stable. Most of this material is non-structural and includes sliced and appearance grade veneers.

The purported 48,031 m$^3$ of imports of veneer in 2015 are considered by stakeholders more likely to have been misclassified square metres of veneer or plywood, or both, according to industry. At an average 7 mm per sheet, this volume would approximate 340 m$^3$ of veneer or plywood. Veneer imports from Australia are reported to be almost entirely of sliced, appearance grade veneers.

The chart and table below provide the details.
Chart 28: PNG Exports of Wood Products to Australia: 2009 – 2016 (m³)

Source: ABS

Table 13: PNG Exports of Wood Products to Australia: 2009 – 2016 (m³)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawnwood</td>
<td>5,742</td>
<td>4,934</td>
<td>5,134</td>
<td>2,302</td>
<td>2,175</td>
<td>1,703</td>
<td>1,250</td>
<td>2,002</td>
</tr>
<tr>
<td>Veneer</td>
<td>153</td>
<td>196</td>
<td>93</td>
<td>34</td>
<td>13</td>
<td>29</td>
<td>48,031</td>
<td>-</td>
</tr>
<tr>
<td>Wood Products</td>
<td>1,178</td>
<td>792</td>
<td>801</td>
<td>558</td>
<td>437</td>
<td>386</td>
<td>453</td>
<td>283</td>
</tr>
<tr>
<td>Plywood</td>
<td>2,352</td>
<td>6,180</td>
<td>10,674</td>
<td>8,787</td>
<td>8,820</td>
<td>8,182</td>
<td>4,935</td>
<td>7,107</td>
</tr>
<tr>
<td>Builders Joinery</td>
<td>34</td>
<td>-</td>
<td>6</td>
<td>-</td>
<td>453</td>
<td>-</td>
<td>101</td>
<td>-</td>
</tr>
<tr>
<td>Other Wood Articles</td>
<td>883</td>
<td>115</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>104</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: ABS

3.3.2 PNG’s imports from Australia
In general, Australia’s wood products exports to PNG are small in volume and focused in part on products not manufactured in PNG (eg. MDF). Builders’ Joinery imports are expected to be more advanced and elaborately transformed wood products, including doors and windows.
This can be observed in the following chart and table.

**Chart 29: Australia’s Exports of Wood Products to PNG: 2009 – 2016 (m³)**

<table>
<thead>
<tr>
<th>YE Dec</th>
<th>Logs</th>
<th>Sawnwood</th>
<th>Veneer</th>
<th>Wood Products</th>
<th>Particleboard</th>
<th>MDF</th>
<th>Plywood</th>
<th>Builders Joinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>169</td>
<td>27</td>
<td>1645</td>
<td>26</td>
<td>700</td>
<td>522</td>
<td>21235</td>
<td>718</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>96</td>
<td>590</td>
<td>124</td>
<td>25378</td>
<td>9184</td>
<td>32</td>
<td>517</td>
</tr>
<tr>
<td>2011</td>
<td>15</td>
<td>1728</td>
<td>1986</td>
<td>5052</td>
<td>472</td>
<td>14950</td>
<td>51</td>
<td>801</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>1091</td>
<td>866</td>
<td>491</td>
<td>849</td>
<td>2004</td>
<td>251</td>
<td>973</td>
</tr>
<tr>
<td>2013</td>
<td>6</td>
<td>12</td>
<td>12636</td>
<td>491</td>
<td>549</td>
<td>749</td>
<td>367</td>
<td>973</td>
</tr>
<tr>
<td>2014</td>
<td>45</td>
<td>1032</td>
<td>656</td>
<td>226</td>
<td>549</td>
<td>1378</td>
<td>1285</td>
<td>1987</td>
</tr>
<tr>
<td>2015</td>
<td>37</td>
<td>490</td>
<td>1643</td>
<td>268</td>
<td>12</td>
<td>4677</td>
<td>508</td>
<td>1117</td>
</tr>
<tr>
<td>2016</td>
<td>10</td>
<td>64</td>
<td>716</td>
<td>552</td>
<td>63</td>
<td>5677</td>
<td>630</td>
<td>2315</td>
</tr>
</tbody>
</table>

**Source: ABS**

The small existing bilateral trade between PNG and Australia is not a constraint to further development, but indicates some significant challenges in trading wood products between the two economies.
PNG is barely able to pay for most of Australia’s wood products, with Australian producers advising the majority of their shipments are for specific projects and industrial and commercial activities, with only very limited ‘retail’ sales.

3.4 PNG’s market for EWPs
Inevitably PNG’s market for EWPs is extremely small by international standards, both in aggregate terms and on a per capita basis. Its production is limited to veneer and plywood, importing all of its particleboard, OSB, MDF and other products.

The chart and table below show PNG’s apparent consumption of EWPs since 2008. The analysis excludes sawnwood products, and also veneer, the bulk of which is used in plywood manufacture.

Chart 30: PNG’s Apparent Consumption of EWPs: 2000 – 2015 (m³)

As described earlier, the major domestic markets for EWPs are for residential dwelling construction, wall paneling, joinery, furniture and some cheap concrete formwork, primarily used for industrial purposes.

PNG’s reported production of EWPs is set out in the following table. Essentially, production is only of two products, veneer and the directly related plywood.
Table 15: PNG Production of EWPs by Grade: 2011 – 2015 (m³)

<table>
<thead>
<tr>
<th>Production (m³)</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veneer</td>
<td>105,000</td>
<td>63,000</td>
<td>63,000</td>
<td>63,000</td>
<td>63,000</td>
</tr>
<tr>
<td>Plywood</td>
<td>44,500</td>
<td>36,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
</tr>
</tbody>
</table>

Source: FAO

3.4.1 Veneer and plywood in PNG

The charts below show PNG’s apparent consumption of veneer and plywood from 2000 to 2015. Though they are not conclusive, they demonstrate that after utilization in plywood manufacture, significant volumes of veneer remain in the market. These are likely to be consumed in the production of paneling and furniture. It is also likely that some is diverted to informal uses, without further transformation.

Chart 31: PNG’s Apparent Consumption of Veneer: 2000 – 2015 (m³)

Source: FAO

Industry reports that the significant rise in consumption of plywood from 2011 is directly linked to the construction phase of the energy resources boom, much of which was supplied by imports of plywood. The plywood imports were – again reportedly – largely of construction formwork.
Chart 32: PNG’s Apparent Consumption of Plywood: 2000 – 2015 (m³)

Source: FAO

The rise and fall in plywood apparent consumption is, in context, exactly the same as any other boom and bust. It must therefore be considered that local utilisation of plywood will cycle through occasional periods of growth. However, even at its peak, the PNG market constituted less than 42,000 m³ (2011), with sustainable consumption appearing to be between 15,000 and 20,000 m³ per annum.

It is obvious that production was able to increase from its consistent base by more than 400% in a single year. It follows that production capacity is significantly higher than underlying domestic demand.

Because of this, industry was asked why production was not retained at higher levels on a consistent basis, with the excess being exported each year. The uniform answer was that PNG’s veneer and plywood products have only a small market niche (related to appearance grades with solid veneer overlays) and are generally uncompetitive in the Asian and global market.

The constraints on market competitiveness are the absence of scale and consistency of resource.

Although this could vary, the minimum scale for a plywood mill is 50,000 m³ of output per annum, requiring a raw log input that could be as high as 125,000 m³ per annum, depending on recovery rates. Recovery rates in PNG are likely to be toward the lower end of the range because the hardwood log resource is increasingly of mixed and variable species and sizes.
The apparent market for veneer is more stable, and more integrated into the domestic market than plywood. The data indicates there are now few exports. Production is consumed locally, both in the production of plywood and into furniture, joinery and wall paneling applications. With no imports, stable consumption should be taken as representing the entirety of national demand.

3.4.2 PNG’s consumption of other EWPs is supplied entirely by imports
The very small volumes of all EWPs other than veneers and plywood are imported to PNG, meaning that the apparent consumption function is the same as the import function.

Our assessment is that the import data for Particleboard, Oriented Strand Board (OSB), Hardboard, MDF and other similar products has in recent years been closely correlated to the consumption of Plywood in PNG.

PNG’s plywood consumption appears to have remained high after the conclusion of the resources construction boom. At the same time, as the charts below show, PNG’s consumption of these other EWPs (all of it imported) has fallen.

In 2010, total known consumption of EWPs other than Plywood totalled just 1,968 m³. That total fell to 1,114 m³ in the following year and has remained at or around that level since.

The charts and tables below show PNG’s imports of these fully imported EWPs.

Chart 33: PNG’s Imports of Particleboard & OSB: 2000 – 2015 (m³)

Source: FAO
Chart 34: PNG’s Imports of Hardboard: 2008 – 2015 (m³)

Source: FAO

Chart 35: PNG’s Imports of MDF-HDF: 2008 – 2015 (m³)

Source: FAO
It seems possible that PNG’s increased production and domestic consumption of Plywood continued after the main phase of the resources boom, at the expense of imported Particleboard, OSB and MDF in particular.

While some of the Plywood has reportedly been used in house bracing, there is observable evidence and industry reporting that indicates joinery and furniture have also utilised more Plywood. These are applications that typically and alternatively use Particleboard and MDF.

Industry consultations and a field visit to a Port Moresby based furniture and joinery manufacturer\(^{16}\) indicated they increased their use of plywood for joinery and furniture products as supplies increased over the last two years.

\(^{16}\)Pryde Furniture, Seven Mile, Port Moresby
Figure 2 & Figure 3: Plywood Kitchen Cabinets at Pryde Furniture: Jun ‘17

Source: IndustryEdge
Part 4

‘Engineered’ Wood Products

The term ‘Engineered Wood Products’ or EWPs refers to a broad group of products that are manufactured from reconstituted wood and that have specific engineering properties and performances. The term is widely used to refer to all reconstituted wood products, somewhat understandably, but also erroneously.

Essentially, although all of the products referred to as EWPs involve some engineering in their design and manufacture, genuine EWPs have engineering applications, particularly in the built environment.

Although contestable, the capital, technological sophistication and general manufacturing complexity of the range of EWPs is assessed, in an indicative manner below.

4.1 Key parameters and challenges for EWP manufacture

Based on some key criteria, the table on the following page provides several assessments of the complexities of EWPs.

*IndustryEdge* is particularly aware that the ‘Minimum Capital’ item is flexible dependent upon a variety of criteria, including the age, quality and completeness of equipment. This data should be treated as a guide only.
Table 16: EWP Capital, Technology, Scale & Manufacturing Complexity

<table>
<thead>
<tr>
<th>EWP</th>
<th>Minimum Capital (USDm)</th>
<th>Technology</th>
<th>Manufacturing Complexity</th>
<th>Minimum Viable Output (m³)</th>
<th>World Scale Output (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary peeled veneer*</td>
<td>&lt;USD1M</td>
<td>Mid</td>
<td>Mid</td>
<td>20,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Sliced/solid veneer</td>
<td>&lt;USD1M</td>
<td>Low</td>
<td>Low</td>
<td>500</td>
<td>5,000</td>
</tr>
<tr>
<td>Plywood – non-structural</td>
<td>&gt;USD5M</td>
<td>Mid</td>
<td>Mid</td>
<td>20,000</td>
<td>450,000</td>
</tr>
<tr>
<td>Plywood - structural</td>
<td>&gt;USD5M</td>
<td>High</td>
<td>High</td>
<td>20,000</td>
<td>180,000</td>
</tr>
<tr>
<td>Cross Laminated Timber</td>
<td>&gt;USD5M</td>
<td>High</td>
<td>High</td>
<td>20,000</td>
<td>250,000</td>
</tr>
<tr>
<td>Medium Density Fibre Board*</td>
<td>&gt;USD10M</td>
<td>High</td>
<td>High</td>
<td>15,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Hardboard*</td>
<td>&gt;USD5M</td>
<td>Mid</td>
<td>High</td>
<td>5,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Oriented Strand Board</td>
<td>&gt;USD5M</td>
<td>Mid</td>
<td>High</td>
<td>12,000</td>
<td>300,000</td>
</tr>
<tr>
<td>Particleboard*</td>
<td>&gt;USD10M</td>
<td>High</td>
<td>High</td>
<td>15,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Glulam</td>
<td>&lt;USD2M</td>
<td>Mid</td>
<td>Mid</td>
<td>2,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Laminated Veneer Lumber</td>
<td>&gt;USD5M</td>
<td>High</td>
<td>High</td>
<td>2,000</td>
<td>120,000</td>
</tr>
<tr>
<td>I Beams</td>
<td>&lt;USD2M</td>
<td>Mid</td>
<td>High</td>
<td>2,000</td>
<td>120,000</td>
</tr>
</tbody>
</table>

Source: IndustryEdge

* continuous process operations
Given the data in the table, it is difficult to escape an apparent reality. There are very few EWPs that PNG could competitively manufacture with its current available wood volume (c. 400,000 m$^3$ pa).

**Scale**

Even if it were to, for example, divert logs from export and commence manufacturing EWPs, it is difficult to observe what market that would serve. With the exception of sliced veneer, for overlaying and appearance outcomes, the other low volume EWP manufacturing options have no apparent demand in PNG and would be faced with insurmountable competition from global, scale manufacturers.

The exception may be rotary peeled veneer (RPV) products, which are examined in more detail later in this section.

**Energy**

A further complicating factor for the manufacture of all EWPs is their requirements for energy, especially electrical energy. EWPs marked with an asterisk in the table above are continuous process operations, for which irregular and intermittent electricity supply is unmanageable. Thus a key requirement for the manufacture of EWPs is a secure supply of electricity.

The following tables have been prepared to analyse the EWPs from the perspective of end-uses and in particular, domestic markets.

### 4.2 Cost of manufacturing EWPs

The cost of manufacturing EWPs depends on a variety of factors. This cost analysis, for all of the foregoing reasons, focuses attention on the manufacture of plywood, from rotary peeled veneer.

The following data is broken down based on two phases – rotary peeled veneer (RPV) and plywood production. These have been separated because it remains a viable option for dried veneers to be sold into more markets, as an intermediate product. The capital and market risks are lower than for plywood production for international markets.

International experience periodically sees RPV produced for a period prior to the investment that results in plywood production.

**Rotary peeled veneer**
The indicative parameters upon which costs have been assessed, are adapted from work conducted in Tasmania in 2015\textsuperscript{17}: 

- 20,000\,m\textsuperscript{3} green log input per annum (billets at average 1.35 m in length)
- 55\% yield to finished veneer product (e. 11,000 \,m\textsuperscript{3})
- 90\% yield from finished veneer to finished plywood product (9,900 \,m\textsuperscript{3})\textsuperscript{18}
- 36\% yield to useable residues (e. 6,120 \,m\textsuperscript{3})

The capital equipment deployed – available for approximately USD1 million – includes a cheap spindleless lathe (available for <USD300,000 on Alibaba), veneer drier, scanner and grader and materials handling equipment, as shown in the image below.

**Figure 4: Integrated RPV Mill**

![Integrated RPV Mill Diagram](image)

*Source: Raute*

The ‘model facility’ would operate on an average 2.5 shifts per day, five days per week.

\textsuperscript{17} Blackburn, D. & Nolan, G. The potential for spindleless lathe rotary peeled veneer in Tasmania, 2015

\textsuperscript{18} This recovery is based on IndustryEdge’s experience modeling successful plywood conversion for a private client
Table 17: Rotary Peeled Veneer Operating Costs: USD

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Unit Cost (USD)</th>
<th>Annual Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green logs (m³)</td>
<td>20,000</td>
<td>135/m³</td>
<td>2,700,000</td>
</tr>
<tr>
<td>Electricity</td>
<td>Monthly</td>
<td>2,000/month</td>
<td>24,000</td>
</tr>
<tr>
<td>Labour (number)</td>
<td>30 people</td>
<td>3,000/annum</td>
<td>90,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>3 people</td>
<td>4,000/annum</td>
<td>12,000</td>
</tr>
<tr>
<td>Management#</td>
<td>3 people</td>
<td>5,000/annum</td>
<td>15,000</td>
</tr>
<tr>
<td>Materials handling#</td>
<td>20,000</td>
<td>5/m³</td>
<td>100,000</td>
</tr>
<tr>
<td>Operating costs*</td>
<td>20,000</td>
<td>5/m³</td>
<td>100,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>3,031,000</td>
</tr>
<tr>
<td>Total USD/m³</td>
<td></td>
<td></td>
<td>275.55</td>
</tr>
</tbody>
</table>

# assumed to be available for plywood manufacture also, at no additional cost

* includes chemicals, fuel, tools and other miscellaneous items

**Plywood**

The specific cost of manufacturing plywood is extremely difficult to assess without considerably more information than is currently available. However, at an indicative level, operating costs once veneers have been produced, and assuming they are supplied at no further cost, have been reported as follows, in two projects.

Table 18: Plywood Manufacturing Costs, Project A - Malaysia¹⁹

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit Cost (USD/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td>35.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>15.00</td>
</tr>
<tr>
<td>Labour</td>
<td>75.00</td>
</tr>
<tr>
<td>Maintenance</td>
<td>10.00</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>15.00</td>
</tr>
<tr>
<td>Total</td>
<td>150.00</td>
</tr>
</tbody>
</table>

¹⁹ Othman, M (Prof. Dr) & Tahir, P. (Prof. Dr), Cost of Production and Energy Consumption in OPT Plywood Manufacturing Under Enhanced Processes on Prepreg Methods, 2014
Table 19: Plywood Manufacturing Costs, Project B – Australia

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit Cost (USD/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td>38.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>31.00</td>
</tr>
<tr>
<td>Labour</td>
<td>125.00</td>
</tr>
<tr>
<td>Maintenance</td>
<td>24.00</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>36.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>259.00</strong></td>
</tr>
</tbody>
</table>

Source: IndustryEdge, adapted from private client analysis

These are only operating costs and they are not comparable between RPV on the one hand and plywood on the other hand. They do not include transport, marketing, sales or regulatory costs. It should be noted that this is not a feasibility study, and the information is indicative only.

4.3 Major end-use markets, applications, criteria and standards for EWPs

As with all wood products (other than fuelwood), the majority of EWPs are deployed in dwelling and other construction, though in substantially different applications and standards.

4.3.1 Major end-use markets for major EWPs

The major end-use markets of the principal EWPs are set out in the table below.

Table 20: Major End-Use Markets for EWPs

<table>
<thead>
<tr>
<th>Major EWPs</th>
<th>Major End-Use Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary peeled veneer*</td>
<td>Plywood</td>
</tr>
<tr>
<td>Sliced/solid veneer*</td>
<td>Plywood</td>
</tr>
<tr>
<td>Plywood – non-structural</td>
<td>General construction</td>
</tr>
<tr>
<td>Plywood - structural</td>
<td>Concrete formwork</td>
</tr>
<tr>
<td>Medium Density Fibre Board</td>
<td>Furniture</td>
</tr>
</tbody>
</table>

Packaging | DIY projects | Bracing | Flooring | Bracing | Joinery
<table>
<thead>
<tr>
<th>Material</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriented Strand Board</td>
<td>Bracing</td>
</tr>
<tr>
<td>Particleboard</td>
<td>Joinery</td>
</tr>
</tbody>
</table>

*intermediate product used in plywood manufacture*
4.3.2 Applications, criteria for EWPs
The table (Table 21) on the following page details the specific applications and key criteria for EWPs.
<table>
<thead>
<tr>
<th>Wood Product</th>
<th>Performance requirements</th>
<th>PNG Species Distinctions</th>
<th>Specific End-use Applications (Global)</th>
<th>PNG^</th>
<th>Competitor EWPs</th>
<th>Competitor Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Hardwood</td>
<td>Structural</td>
<td>Mixed hardwood</td>
<td>House framing and floorboards (75%)</td>
<td>46,500</td>
<td>Plywood, Glulam, LVL, I Beam</td>
<td>Sawn Softwood</td>
</tr>
<tr>
<td>Appearance</td>
<td>Tropical specialties</td>
<td></td>
<td>Furniture/joinery (5%)</td>
<td>3,100</td>
<td>Plywood</td>
<td></td>
</tr>
<tr>
<td>Structural</td>
<td>Mixed hardwood</td>
<td></td>
<td>Industrial building framing &amp; flooring and some packaging (20%)</td>
<td>12,400</td>
<td>Plywood, Glulam, LVL, I Beam</td>
<td>Steel, Aluminium</td>
</tr>
<tr>
<td>Sawn Softwood</td>
<td>Structural</td>
<td>Mixed</td>
<td>Housing (80%)</td>
<td>16,000</td>
<td>NA</td>
<td>Plywood, Glulam, LVL, I Beam</td>
</tr>
<tr>
<td>Appearance</td>
<td>Mixed</td>
<td></td>
<td>Furniture/joinery (5%)</td>
<td>1,000</td>
<td>Plywood</td>
<td>Sawn Hardwood</td>
</tr>
<tr>
<td>Structural</td>
<td>Mixed</td>
<td></td>
<td>Industrial building framing and some packaging (15%)</td>
<td>3,000</td>
<td>Plywood, Glulam, LVL, I Beam</td>
<td>Steel, Aluminium</td>
</tr>
<tr>
<td>Rotary peeled veneer*</td>
<td>Intermediate</td>
<td>Mixed hardwood</td>
<td>Plywood</td>
<td>62,500</td>
<td>USD333 (E)</td>
<td>-</td>
</tr>
<tr>
<td>Sliced/solid veneer</td>
<td>Appearance</td>
<td>Tropical specialties</td>
<td>Plywood - Wall panelling</td>
<td>100</td>
<td>Plywood</td>
<td>Composites</td>
</tr>
<tr>
<td>Appearance</td>
<td>Tropical specialties</td>
<td></td>
<td>Plywood - Furniture</td>
<td>200</td>
<td>Plywood</td>
<td>Composites</td>
</tr>
<tr>
<td>Structural</td>
<td>Mixed</td>
<td></td>
<td>Plywood - Joinery</td>
<td>200</td>
<td>OSB</td>
<td>Composites</td>
</tr>
<tr>
<td>Plywood – non-structural</td>
<td>Intermediate</td>
<td>Mixed hardwood</td>
<td>Housing/Industrial (85%) ([a])</td>
<td>23,800</td>
<td>OSB, Particleboard</td>
<td>Concrete/Aluminium</td>
</tr>
<tr>
<td>Plywood - structural</td>
<td>Structural</td>
<td>Mixed hardwood</td>
<td>Housing/Industrial (15%)</td>
<td>4,200</td>
<td>OSB</td>
<td>Concrete</td>
</tr>
<tr>
<td>Cross Laminated Timber</td>
<td>Intermediate</td>
<td>Softwood</td>
<td>Housing/Industrial</td>
<td>-</td>
<td>NA</td>
<td>Plywood, OSB</td>
</tr>
<tr>
<td>Medium Density Fibre Board*</td>
<td>Intermediate</td>
<td>Mixed</td>
<td>Furniture/joinery</td>
<td>49</td>
<td>USD585 (I)</td>
<td>Particleboard, Plywood, MDF</td>
</tr>
<tr>
<td>Hardboard*</td>
<td>Intermediate</td>
<td>Mixed</td>
<td>Housing</td>
<td>710</td>
<td>USD465 (I)</td>
<td>MDF</td>
</tr>
<tr>
<td>Oriented Strand Board</td>
<td>Intermediate</td>
<td>Mixed</td>
<td>Housing</td>
<td>70</td>
<td>USD465 (I)</td>
<td>Particleboard, MDF, Plywood</td>
</tr>
<tr>
<td>Particleboard*</td>
<td>Intermediate</td>
<td>Mixed</td>
<td>Flooring/Housing/Joinery</td>
<td>70</td>
<td>USD465 (I)</td>
<td>MDF, OSB</td>
</tr>
<tr>
<td>Glulam</td>
<td>Structural</td>
<td>Mixed</td>
<td>House framing</td>
<td>-</td>
<td>NA</td>
<td>LVL, I Beam</td>
</tr>
<tr>
<td>Laminated Veneer Lumber (LVL)</td>
<td>Structural</td>
<td>Mixed hardwood</td>
<td>House framing</td>
<td>-</td>
<td>NA</td>
<td>Glulam, I Beam</td>
</tr>
<tr>
<td>I Beams</td>
<td>Structural</td>
<td>Mixed hardwood</td>
<td>House framing</td>
<td>-</td>
<td>NA</td>
<td>Glulam, LVL</td>
</tr>
</tbody>
</table>

* continuous processing
^ 2015
some structural applications
# data supplied by PNGFA, and is export based on Fob rate (E) or based on imports to PNG (I)
" Estimate based on 2 small shipments from PNG to Australia in 2015
(a) The major end-use markets for housing non-structural plywood is as bracing and flooring material and industrial non-structural plywood are concrete formwork and container flooring, as well as some packaging
4.3.3 General standards for EWPs
At a general level, the global market standards for EWPs are quite similar to those required of all wood products:

- Fitness for purpose
- Legality of sourcing
- Independent provenance verification or third party certification

These are clear general requirements for international markets (including Australia and New Zealand) and should be expected, as a matter of conservative market positioning and access for any EWPs arising from PNG.

The same cannot be said for PNG's domestic markets. Taking into account all of the previously defined major market opportunities, especially for veneer products, the following sets out typical international standards for major applications for plywood, and the subsequent section addresses implied requirements for domestic markets.

**International standards for plywood, for specific applications**

In an Australian context – similar in New Zealand, Japan and other advanced markets – there are a range of application specific standards for plywood. Those applicable to Australia and New Zealand are:

- AS/NZS 2269: 2008 Plywood – Structural
- AS/NZS 2270: 2006 Plywood and Blockboard for Interior Use
- AS/NZS 2271: 2004 Plywood and Blockboard for Exterior Use
- AS/NZS 2272: 2006 Plywood – Marine
- AS/NZS 4357: 2005 Structural Laminated Veneer Lumber
- AS 6669: 2007 Plywood Formwork

It should be noted there are also construction specific standards to be met in each jurisdiction.

The following set out clear standards for plywood, for specific applications.

---

a. **Shipping container flooring**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>2400 x 1200 preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness / Plies</td>
<td>28 mm – average 19 plies</td>
</tr>
<tr>
<td>Density</td>
<td>750-800 kg/m³</td>
</tr>
<tr>
<td>Weight</td>
<td>60-65 kg per board</td>
</tr>
<tr>
<td>Treatment</td>
<td>Veneer impregnation and/or pressure treatment of plywood</td>
</tr>
<tr>
<td>Certification</td>
<td>JAS-ANZ\textsuperscript{21} required in Australia and New Zealand, involving testing to meet one or more of the Australian and New Zealand Standards set out above</td>
</tr>
</tbody>
</table>

b. **Concrete formwork**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>2400 x 1200 or 1800 x 1200 preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness / Plies</td>
<td>7 mm to 25 mm, averaging 17 mm</td>
</tr>
<tr>
<td>Density</td>
<td>550 - 600 kg/m³</td>
</tr>
<tr>
<td>Weight</td>
<td>14.2 kg per board – 1800 x 1200 x 12</td>
</tr>
<tr>
<td></td>
<td>27.5 kg per board – 2400 x 1200 x 17\textsuperscript{22}</td>
</tr>
<tr>
<td>Treatment</td>
<td>Veneer impregnation and/or pressure treatment of plywood</td>
</tr>
<tr>
<td>Certification</td>
<td>JAS-ANZ required in Australia and New Zealand, involving testing to meet AS6669 Plywood-Formwork (inc. AS/NZS2269 and AS2754.1)</td>
</tr>
</tbody>
</table>

\textsuperscript{21} Joint Accreditation Scheme of Australia and New Zealand

### Structural plywood

| Dimensions          | General: 2400 x 1200 and 2700 x 1200 preferred  
|                    | Bracing: 2440, 2700 or 2745 x 1200 available  
| Thickness / Plies   | 4 mm – 25 mm  
| Density             | <700 kg/m³  
| Stress Grade        | Tested and recorded  
| Weight              | Variable to approx. 62 kg per board  
| Treatment           | Veneer impregnation and/or pressure treatment of plywood  
| Certification       | JAS-ANZ required in Australia and New Zealand, involving testing to meet one or more of the Australian and New Zealand Standards set out above  

### PNG's domestic standards for plywood, for specific applications

Data describing specific standards for plywood (or other EWPs) for application in PNG are difficult to discern, but may be inferred. Inevitably, unlike Australia and New Zealand, a robust national standards system is not in operation, and the extent of the informal sector is so great that it would not be properly monitored, in any event.

Standards for plywood use in PNG can be inferred by the expectations placed upon the specific applications for which plywood is deployed. In particular, this relates to housing formats.

The major concern about wood products in general that was expressed to *IndustryEdge*, was that unpreserved timber has a relatively short life, in almost all applications, because of pest infestation and moisture ingress. This was explained from the perspective of housing built from timber, compared with other materials, and was not broken down to a particular element of housing (eg. framing, flooring, cladding, joinery) that could be prone to fail. Our observation arising from this feedback is that timber’s reputation as a building product is significantly diminished, in almost all respects, because significant supply volumes are not preserved.

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23 EWPAA, Specification guide for the professional and home handyperson  
There is a potential qualification to this observation. We also observed that with respect to interior use of plywood – for joinery – that moisture resistance is a pre-requisite, along with treatment for pests. It was explained that plywood joinery was preferred in many situations because of its enhanced moisture treatment properties, relative to the potential substitutes – particleboard and MDF.

So, we conclude from these reference points that PNG’s domestic standards for plywood are, as a minimum:

a. Veneers are impregnated to a standard fit for specific purpose ~ our suggestion is that the relevant Australian and New Zealand standards could be adopted for this purpose
b. Plywood is pressure treated to a standard fit for specific purpose ~ our suggestion is that the relevant Australian and New Zealand standards could be adopted for this purpose
c. Adaptation or development of a simple branding system to encourage utilisation on a ‘fit for purpose’ basis.

It should be clear that achieving such a standard and having it adopted in the PNG marketplace requires considerable effort, as a promotional and marketing exercise and as an industrial process requiring capital investment and skills development. A demonstration project approach to this, potentially linked to the proposed timber-processing hub, may be a suitable place to commence this activity.
Part 5

Developing the market for durable EWPs in Australia

EWPs that are durable in the market – holding a permanent position – are already well established in the Australian markets they serve. The important roles of the industry’s Research & Development Corporation, Forest & Wood Products Australia (FWPA) and the industry association, the Engineered Wood Products Association of Australasia (EWPAA) continue to be fundamental to the market and its further development.

5.1 EWPs in the Australian context

Adopting the ‘engineering’ centric definition of engineered wood products (EWPs) as set out in Part 4 of this analysis, there is a small range of products worthy of considering in Australia’s full market context.

Once considered to be value adding to residual resource, wood panels are now a major product range with some inherent advantages over sawn wood products, in many situations. Wood panels are typically manufactured by reconstituting wood that has been reduced from a log into smaller sized pieces, by a variety of means. The major types of wood panels are:

- **Plywood** – manufactured from veneers (either rotary peeled or sliced)
- **Cross Laminated Timber** – manufactured from veneers, plywood and smaller timber pieces
- **Particleboard** – manufactured from woodchips and fines
- **Medium density fibreboard (MDF)** – manufactured from woodchips and fines
- **Oriented strand board** – manufactured from shredded wood
- **Hardboard** – manufactured from fines and particles.

EWPs utilise wood panels (especially plywood) to manufacture products to structural specifications that can be used to substitute for major hardwood sections, as well as concrete and steel.

Because of their uniformity, light weight and the ability to manufacture them quickly and to precise specifications, EWPs such as the common Laminated Veneer Lumber (LVL) are becoming more widely used in multiple dwellings, building on their share of Australia’s domestic free standing housing market.
New products, such as Cross Laminated Timber (CLT)\(^{24}\) have the potential to redefine elements of global and Australian housing and construction, although the potential is nascent.

The production of EWPs typically utilises a higher proportion of available wood fibre than sawnwood. As resource constraints continue and increase, so the production and utilisation of wood panels, including massed-timber panels like CLT, will likely increase.

Australia’s demand for the major EWPs, from 2006 to 2016 is displayed in the following table and chart, noting that the ‘Plywood’ designation includes LVL and Glulam, if not CLT.

**Chart 37: Australian Consumption of EWPs by Main Grade: 2006 – 2016 (km\(^3\))**

![Chart showing consumption of EWPs from 2006 to 2016](chart.png)

*Source: ABS, EWPAA and IndustryEdge*

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\(^{24}\) Cross-Laminated Timber (CLT) is a form of massed timber panel, representative of a range of building materials that are defined and described in different ways, but that predominantly focus on production of timber panels that are largely factory-built and more easily installed than traditional ‘stick-built’ housing frames, and even more than factory built ‘frames’.
5.2  Australia’s EWP needs
At a theoretical level, national markets engaged in sophisticated and comprehensive international trade may be taken as having their supply needs met, in all conditions, with price the varying factor. It is reasonable to assume that this is broadly true in respect of a specific moment in time and thus applies to historical supplies of EWP in Australia. That is, EWP consumption over a period may be taken as meeting exactly the market need for that period.

However, this is a less than adequate consideration because it fails to take into account how needs are changing over time and may ultimately ignore the drivers of those changes.

To gain a proper understanding of Australia’s EWP needs into the reasonable future, it is important to consider two primary factors: how demand is changing, and why it is doing so.

5.2.1  How Australia’s EWP demand is changing
Viewed from an historical consumption standpoint, Australia’s demand for EWP is changing because Australia’s housing mix and style is changing, and the demands of consumers are becoming more exacting and precise.

Changing housing types
Australia’s long-running housing boom, depicted in the chart below, saw significant growth in the volume of multi-storey dwellings being approved and constructed.
It can be observed that the multi-storey boom has declined since late 2016, but the firmament of Australia’s housing market - free-standing houses – has experienced stability at near-record levels over the last four years. In many respects, this base of housing demand – and stability of supply of building materials – has been ignored in the multi-storey housing boom.

While many of the additional multi-storey dwellings are in ‘towers’, there is a significant proportion that is understood to be ‘mid-rise urban infill’. Widely referenced research – summarised below – shows that this sub-sector is very large and could contribute as much as 1.115 million new dwellings from 2015 to 2045 in Sydney, Melbourne and Brisbane alone.

**Source: ABS**
This opportunity for all forms of construction was enhanced for wood products on 1st May 2016 by the decision to allow mid-rise residential buildings to be constructed of timber. The facilitative amendments made to the National Construction Code are comprehensive and complex, but since the announcement, industry guidance is that the market has further developed.

Leading global wood products companies are constantly promoting these opportunities in Australia and globally, and are actively pursuing them, as the following images indicate.
Additionally, to support the new developments allowing taller timber construction, FWPA has engaged specialist advisory staff to assist designers, architects, developers and builders to implement the new arrangements. 

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This market development is in its early stages, but there are important pointers to the future market arising from it.

Expectations are that mid-rise timber buildings constructed of timber, will be manufactured in factories, with services largely pre-fitted, and supplied direct to site for rapid installation. The extensive building and engineering standards that need to be met, as well as the modularised nature of the construction, lend themselves to the use of EWPs.

It is widely anticipated that this development will expand the use of EWPs in Australia’s dwellings, forcing ever more production off-site and into factories.

Products that are likely to be the beneficiaries of consumption growth include structural plywood, CLT and LVL beams. Though none of these is likely to be feasible for products manufactured in PNG, mid-rise buildings constructed of timber may well have floors made of timber, as well as possibly appearance grade wooden wall panelling. These products could be manufactured from sliced veneers and parquetry pieces from PNG.

**Consumer expectations and certification**

In a rapidly evolving consumer landscape, expectations are constantly changing and becoming more exacting. In Australia, as with most other developed and semi-developed economies, consumers expect their products will meet environmental and social expectations.

In Australia, this manifests itself in an expectation that wood fibre used in timber products – especially those with which consumers have a direct interface such as furniture – will be independently certified. Both of the main global certification schemes – the Program for Endorsement of Forest Certification schemes (PEFC) and the Forest Stewardship Council (FSC) – are acceptable as ‘standards’ in general.

However, because of its promotion by activists, for some products, certification to FSC standards is expected, above all others. There is little doubt that the FSC’s adoption as a requirement by some firms is a defensive measure to ensure they are not engaged in actions against their entire business and/or product lines. While that seems unreasonable to some, it is a commercial reality and one that in many cases cannot be avoided by suppliers, no matter how small or how well they otherwise articulate their sustainability.

Certification – at least to the level of the ‘Chain of Custody’ – should be considered a pre-requisite for secure and ongoing supply into the Australian market, for all wood products and products manufactured from wood.
5.3 Activities developing the Australian industry

A range of activities are already undertaken to develop – on a continuous basis – the market for EWPs in Australia.

The general programs of FWPA include public marketing of the benefits of dwelling construction using timber, as well as large, specific and multi-year activities to support the uptake of timber building systems by building professionals. The latter is described above at 5.2.1.

Importantly, the Engineered Wood Products Association of Australasia (EWPA) operates a well-established and near universally applied certification system and programs. These schemes, integrated with the relevant Japan Agricultural Standards (JAS), which is linked with the relevant Australian Standards. The JAS-ANZ certification systems provide certification for Plywood (including LVL), MDF and Particleboard. Details can be found at http://ewp.asn.au/certification.

It is widely considered that for most markets, especially those involving appearance grade plywood, EWPA certification is required for market access. Although there is work always required by facilities to achieve certification, it is noted that EWPA certification is already achieved by producers in PNG, as well as in Australia, Fiji and New Zealand.

5.4 Market opportunities for PNG

Operating within its resource constraints, there are opportunities for PNG industry to expand its supply into Australia, albeit on a limited basis.

It can be observed that PNG’s shipments to Australia are quite inconsistent and mainly, at very low levels. Opportunities to grow PNG’s contribution to Australia’s wood products supplies would require improved consistency of supply, among other factors.

When considering opportunities of this nature, it is important to take into account the following factors.

Third-party certification

For instance, as set out in Section 3.2.1, Australia is a market in which it is prudent to assume – especially for consumer markets – that independent third-party certification is required. There are other market pre-conditions, including for most products, their capacity to meet the requirements of Australian Standards, the National Construction Code (NCC) and specific product requirements, including those requiring product treatment.
**Global cost competitiveness**

Although a higher-value market, Australia is part of the global marketplace and will reference most of its procurement decisions on the basis of like goods at the lowest price. Wherever there is an element of competition, cost competitiveness is fundamental to market development.

**Supply side concentration in PNG**

In terms of PNG’s market structure, it cannot be avoided that the very significant majority – some suggest as much as 90% - of PNG’s wood resources are controlled by one company, from concession, through harvest, processing and both domestic use and export. The implication is that the allocation of resource and wood products to particular destinations is determined by one corporate entity. Expanding exports to Australia (or anywhere else) must therefore include a decision by major companies to pursue market opportunities in Australia, instead of, or in addition to existing export markets.

5.4.1 **Specific market opportunities**

The small volume of existing exports from PNG to Australia is instructive, but not the limit of the opportunities for PNG’s wood product exports. Existing supply arrangements can be extended and expanded and new buyers can potentially be found for the same products.

**The importance of niche markets**

Broadly, PNG’s opportunities are more likely to be in niche rather than commodity applications. Given the volume efficiencies available to some competitors, niche markets are more likely to provide opportunities to sustainably grow its supply into Australia.

It is important to understand that a niche market is not necessarily a small market, though that is often the case. A niche product has one or more characteristics that are unique, that is a critical input to another product, or a subset of a larger product offering.

An actual example pertinent to PNG is that the manufacture of timber bridges has within it several potential wood supply niches: heavy bridge timbers, heavy bridge timbers that can be submerged, and bridge decking timbers all represent genuine opportunities to establish a niche market.

It is implied in this that niche markets require targeting and development, often in conjunction with partners and especially so, for export markets. This consideration is addressed in Section 6 of this analysis.
Linking market need with supply capacity

Although any market opportunity has to be assessed from the perspective of the market 'need', it must quickly refer back to supply-side capacity. To ensure that there is a close relationship demand (opportunity) and supply (capacity), two approaches have been used: a. demand-side assessment and b. supply-side capacity.

It should be noted that with respect to supply-side capacity, a ready market may not currently exist, but the conduct of a market development program can establish a market. This is a clearly more entrepreneurial and speculative approach than seeking to fill an established demand opportunity.

The following sets out the demand opportunities and apparent supply capacities. Where possible, market data is also supplied. Section 6 addresses methods by which markets can be developed and further market access achieved.

a. Australian demand opportunities

Australia, like much of the rest of the world, is fast approaching a domestic fibre deficit.\(^{26}\) In Australia, this deficit may be masked for a few short years as the current, deep and long running residential property boom is coming to an end, with related demand for wood products inevitably reducing.

However, the shortage exists and is especially serious for heavier and structural grades of timber, both for the housing market and for the industrial and infrastructure market in particular.

For products that can be supplied by hardwood species, we note that Australia's continual reduction in access to native forests has had the effect of reducing the supply of locally supplied timber products, possibly opening up further opportunities for wood products from PNG to meet demand.

Wood products for which there is high demand in Australia include:

- Hardwood windows, window frames and door frames
- Hardwood floorboards
- Hardwood parquetry flooring pieces
- Mouldings and other manufactured timber 'pieces'
- Tropical hardwood appearance veneers (mainly sliced)

\(^{26}\) Although a net exporter of wood fibre (roundwood and wood chips in particular), Australia is a net importer of sawn softwood, used almost entirely in domestic dwellings
The data below demonstrates the size and value of the Australian import market for some of these products.

Table 22: Relevant Wood Product Imports to Australia: 2016 (AUDFOB, m², m³, m, AUDFOB/unit & %)

<table>
<thead>
<tr>
<th>Product</th>
<th>2016 Import Value (AUDFOB)</th>
<th>2016 Import Volume (where available)*</th>
<th>Ave. Price (AUDFOB/unit)</th>
<th>% of Value Supplied by Oceania (inc. PNG^)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood dowelling</td>
<td>416,056</td>
<td>-</td>
<td>-</td>
<td>13.9</td>
</tr>
<tr>
<td>Hardwood picture frame mouldings (metres)</td>
<td>11,027,704</td>
<td>5,204,156 m</td>
<td>2.12/m</td>
<td>0.0</td>
</tr>
<tr>
<td>Other hardwood timber pieces, inc. floorboards (m³)</td>
<td>224,320,167</td>
<td>145,818</td>
<td>1,538/m³</td>
<td>0.1</td>
</tr>
<tr>
<td>Windows &amp; frames</td>
<td>24,235,504</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Doors &amp; frames</td>
<td>63,153,462</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Posts &amp; beams</td>
<td>104,933,101</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Mosaic &amp; parquetry floors (m²)</td>
<td>106,224,888</td>
<td>3,647,175</td>
<td>29.13/m²</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Veneer sheets – sliced laminated (m³)</td>
<td>6,950,210</td>
<td>4,431</td>
<td>1,568/m³</td>
<td>0.0</td>
</tr>
<tr>
<td>Veneer sheets – rotary peeled (m²)</td>
<td>12,252,551</td>
<td>5,166,894</td>
<td>2.37/m²</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Plywood (m³)</td>
<td>334,564,840</td>
<td>401,256</td>
<td>833.79</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: ABS

It may be observed that the Oceania region (here dominated by PNG, with small shipments from the Solomon Islands, and entirely negligible shipments from other Pacific island nations) supplies very little of Australia’s imports of the potential opportunity timber products.

Wood products for which there is ongoing, but potentially less stable demand are larger timber members, able to be used for the construction of bridges, piers and similar infrastructure. One Australian industry participant advised that this was a market that would expect to receive a large roughsawn timber piece, ready for secondary milling to specific dimensions for in situ installation. These timbers are very difficult to isolate in the trade data.
Additionally, as a high-value global market, Australia is a net importer of furniture. Accessing furniture markets and furniture componentry markets is also addressed in Part 6.

Emerging EWPs, especially those products such as Cross-Laminated Timber (CLT) are only just being manufactured in Australia, meaning in large part they are being imported, where they are in use at all. Because they are new products, they are generally not specifically defined within trade data. Instead they are widely included under the amorphous ‘Builders’ Joinery’ classifications of the Harmonised Tariff Item Statistical Code (HTISC), which unfortunately record only the value of the imports, not the number of units or their mass (m$^3$ or m$^2$) or weight (tonnes).

As a result, imports are unclear from analysis of formal data, but are in any event relatively small. The products are significantly more sophisticated than any that could be manufactured in PNG.

b. PNG supply capacity

PNG has several supply advantages and opportunities for supply into international markets including Australia. These are largely focused on niche supply, not specifically defined by size, but by unique characteristics:

- **Sliced veneer** for appearance grade plywoods and application to other wood panels and wood products. End-use applications, as defined elsewhere in this analysis, include furniture, high-end joinery and wall paneling.

  Turning supply capacity into market opportunity requires market development activities in Australia, and the meeting of standard market conditions, including consistency of supply.

- **Rotary peeled veneer** for manufacture into plywood. The resource efficiency of peeled veneer compared with sawnwood makes rotary peeling attractive, particularly for species able to contribute to meeting required densities and other plywood performance properties.

  Veneer supply is highly price competitive, meeting the preservation and provenance standards described elsewhere in this analysis is fundamental to developing and maintaining market access and independent third-party certification is highly desirable.

- **Timber mouldings and dowelling** are not EWPs, but it is conceivable that Australia’s very large market for these products could be met in part by supply from PNG that is manufactured in an integrated environment.

  It should be noted that marketing and sales partnerships for EWPs could be leveraged to include these products.
• **Furniture, joinery and wall panels** are specific applications of EWP's that could – as tertiary manufactured goods – be viably produced in PNG and shipped as finished or near finished product to Australia.

The heavy qualification on this opportunity is that the lack of scale and industrialisation of PNG’s manufacturing means this is only likely to be feasible at the very highest and most precisely specified end of the market. It is not a commodity market play. As such, it is likely that market development with designers and bespoke manufacturers or retailers would be required for this opportunity to be realised.

The prior work of the PNG Forest Industries Association (PNGFIA) should be noted. The prior work of the PNG Forest Industries Association (PNGFIA) should be noted. It details the types of products to which the PNG industry understands its available timber species can be deployed. Although not an end point, this is a useful preliminary tool for assessing capacity to supply to certain product markets.

5.4.3 No opportunities to supply the majority of the EWP market – Particleboard and MDF

There are no market opportunities for PNG to supply either Particleboard or MDF in Australia.

In 2016, analysis by *IndustryEdge* for Forest & Wood Products Australia (FWPA) demonstrated that imports accounted for just 10.9% or 118,927 m³ of Particleboard consumption for the year and 12.9% or 84,044 m³ of MDF consumption for the year. This is shown in the table below.

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27 PNGFIA (P.J. Eddows), 2015, The Utilisation of Papua New Guinea Timbers

Table 23: Apparent Consumption of Particleboard and MDF: 2016 (m³)

<table>
<thead>
<tr>
<th>Source</th>
<th>Particleboard (m³)</th>
<th>MDF (m³)</th>
<th>Total (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>952,809</td>
<td>571,622</td>
<td>1,524,431</td>
</tr>
<tr>
<td>Less Exports</td>
<td>2,046</td>
<td>1,936</td>
<td>3,982</td>
</tr>
<tr>
<td>Plus Imports</td>
<td>118,927</td>
<td>84,044</td>
<td>202,971</td>
</tr>
<tr>
<td>Total</td>
<td>1,069,690</td>
<td>653,730</td>
<td>1,723,420</td>
</tr>
</tbody>
</table>

Source: ABS, EWPAA and IndustryEdge

Imports of each of these major EWPs are from the following countries, respectively.

Chart 39: Particleboard Imports by Country: 2016 (%)

Source: ABS

* NCD = no country details (all of which is raw board)

Chart 40: MDF Imports by Country: 2016 (%)
These are large markets, internationally competitive and participated in by major global manufacturers whose modern scale dwarfs anything possible from PNG.

5.4.4 Market requirements to access wood product markets in Australia

In general, the requirements that must be met to access – and maintain access – in wood products markets in Australia be summarised as follows:

- Australian legislative requirements are met, especially with respect to the *Australian Illegal Logging Prohibition Act, 2012*.\(^{29}\)
- Australian Standards specific to either product or application
- Consistency of supply, both with respect to quality and volume
- Specific application standards defined by buyers/end-users (fitness for purpose)
- Price competitiveness with alternative supply options

In specific, most of the market prefers sustainability outcomes to be independently certified to either the Forest Stewardship Council (FSC) or Program for Endorsement of Forest Certification scheme (PEFC). This includes, where relevant, chain-of-custody certification. It is noted that such schemes are automatically deemed to meet the requirements of the *Australian Illegal Logging Prohibition Act, 2012*.

\(^{29}\)http://www.agriculture.gov.au/forestry/policies/illegal-logging
It can be observed that these criteria for market access are a mix of regulatory (including certification) and operational requirements. The former are fixed and well established, even standardized across Australian industry. The latter are specific to end-users – or at least they may be – and have to be negotiated on a case-by-case basis in many instances.

It may therefore be understood that accessing markets in Australia requires a focus on end-users and customers that may be challenging for many of PNG’s small forestry and wood products businesses.
Part 6

Opportunities, constraints and recommendations for development activity

Despite some serious constraints on industrialised development of PNG’s wood products markets, especially from a global and international perspective, there are apparent opportunities. In the main, these are integrated directly to PNG’s needs, to the country's growing population and improving living standards, and to its likely potential for growth.

Detailed below are the likely series of opportunities and assessment of them, followed by a series of constraint assessments and recommendations for further consideration.

6.1 Opportunities
Based on the available information, field discussions and data analysis, IndustryEdge considers there are four relevant opportunities for the development of PNG’s wood products sector:

- Sustainable residential dwelling construction (PNG);
- Specialised infrastructure and industrial supply (PNG);
- Supply of sustainable energy (PNG);
- Unique species and specific product marketing (International)

Each of these is considered below.

6.1.1 Sustainable residential dwelling construction
Integrated to PNG’s specific needs, the primary opportunity for the development of a durable wood products market, including for EWPs, is a focus on the supply of sustainable residential dwellings, particularly in key population centres.

Annual demand is estimated at 35,542 new dwellings per annum, of which less than 24% (8,495) are built using non-traditional means. The average residential dwelling is calculated to include 6.40 m$^3$ of wood products in its construction, providing baseline demand of 54,393 m$^3$ of formally produced wood products per annum.
Assuming total housing demand remains static – a very conservative approach given PNG’s apparent population profile and growth – a clear opportunity exists to enhance the value from PNG’s wood products.

Wood products are used throughout residential dwellings. Broadly they might be considered as:

- Structural
- Flooring
- Frames and trusses
- Cladding
- Windows and doors
- Joinery
- Decking

We are advised that one wood products manufacturing firm is already using its materials and expertise to construct residential dwellings to some form of pre-fabrication, delivering the value added ‘components’ to sites for assembly.

This approach captures more of the value of wood products for the wood products manufacturer and also encourages ‘fit for purpose’ utilisation and assembly. It may also provide an increased driver to ensure that wood is properly treated, an often reported constraint of the un-integrated and informal elements of the wood products manufacturing sector.

To give effect to this opportunity, improved supply chain collaboration is required. This is explored further in 6.3 below.

**Impact of the informal housing sector**

It is noted that the informal housing sector is large and adds significantly to demand for wood products. It is difficult to assess the specific size of the informal sector, but it is reasonable to make some estimations of its importance.

The informal housing sector adds to demand for wood products, but by its very nature is more prone to utilisation of wood products (including EWPs) that do not meet the product standards described in Section 4.3.3 above. This in turn reduces the market and dilutes the drivers for compliance with product performance standards within PNG.

**Potential solution:** establishing an aggregated supply-side model that provides economic encouragement (sale of wood) into the CPU or related supply-chain on a consistent basis (which may include contracted volumes for instance), may assist in reducing the influence of the non-conforming informal sector.
6.1.2 Specialised infrastructure and industrial supply
Just as with pre-fabricated residential dwellings, other forms of buildings, including those built by Government agencies and companies, can be pre-fabricated. Examples are smaller social and community buildings and 'site' huts and other buildings.

It is likely that, unlike the recent construction phase of the energy resources boom, developing capabilities in the supply of small non-residential buildings will be a more consistent value adding opportunity.

Additionally, several interviewees identified small-scale EWP bridges and other critical infrastructure as opportunities for value added wood products in PNG. It was considered, based on a recent example, that the lighter, faster to build and immediately available options presented by EWPs make them ideal where urgent and immediate solutions are required.

It has not been possible to quantify the potential size of these market opportunities.

Again, collaboration is likely to be required to ensure that the sector has the combined capabilities to deliver this opportunity, especially if engaged by Government agencies on a whole of country basis.

6.1.3 Supply of sustainable energy
If there is a distinguishing characteristic between PNG's wood products sector and that of more industrialised countries (for example, Australia), it is the lack of utilisation of residues arising from production. Already beset by challenges to optimal recovery of solid wood products, PNG appears to undertake little or no value-adding of its wood residues.

Some producers reportedly pay to have their residues removed from their facilities. Others stockpile the residues, allowing them to be removed by locals for cooking and heating fuel. A small quantity of residues appears to be used to create thermal heat, for the drying of sawn wood and other products.

Within PNG, biomass energy generation appears to be gaining some traction, with PNG Biomass due to commence operation of a 15 megawatt biomass-derived baseload power facility linked to the Ramu grid in 2018. It will expand to 30 megawatts relatively soon thereafter.30

One wood products manufacturer dries high value sliced veneer by air, without using thermal energy, but pays to have its wood residues removed.

30 http://www.alignedenergy.net/png-biomass-energy-project-gets-green-light/
Air drying is of course an option, as is the seemingly under-utilised solar energy option, as other analysis for ACIAR has observed.\(^{31}\)

However, use of residual biomass, as a source of energy, has significant potential utility in a country that faces energy challenges.

At the regional level, with the right investment, local biomass could supply electrical energy currently supplied by fossil fuels. In major population centres, biomass can be co-fired with other fuels for general purposes.

But for the wood products industry, the effective utilisation of its own residues to provide thermal heat and electricity to conduct its own activities can be the difference that establishes sustainability.

Again, the wood residues are insufficient in volume to allow significant discreet investment by separate businesses. It is generally likely to only be via collaboration that large volumes of wood residues can be captured and commuted to energy options.

**Scale matters, but is not insurmountable**

The scale of industrial biomass energy operations is important to cost efficiency. Within limits, the larger scale facilities are the more efficient.

However, technological innovation has resulted in smaller-scale biomass energy solutions being implemented, as part of the means by which electricity is supplied to industrial facilities and also to adjacent premises, both industrial and residential.

As the details below suggest, at the lower end of industrial scale biomass energy generation, approximately 200,000 m\(^3\) of green woody biomass would be required to produce approximately 20 Megawatts of electricity for a capital cost of between USDM60.0 and USDM70.0.

\(a\). **Capital costs**

In general, capital costs for biomass energy generation at modest scale (20-30 Mw) are between USDM3.0 to USDM3.5 per megawatt. There are generators operating at <10 megawatts and suggestions that they can efficiently generate power from a base of 5 megawatts.\(^{32}\)

\(^{31}\) Jeremiah, H. (2017), Gap assessment of wood processing companies in PNG, Unitech

\(^{32}\) PNG Biomass Power Project (2017), [http://pngbiomass.com/power-plant/biomass-power/]
b. **Wood supply needs**

As a rule of thumb, 10,000 m$^3$ of green wood is required to produce 1 megawatt of energy. The specific calorific content of wood depends upon species, density, moisture content, humidity and the time it has been left to dry. For useful discussion and elaboration on measurements, see the *Wood Fuels Handbook* produced by the Food & Agriculture Organisation of the United Nations.\(^{33}\)

Despite investigations, we have not found any reference material pointing to specific assessments of PNG’s tree species for the purposes of biomass utilisation.

c. **Co-firing opportunities**

It is noted that woody biomass – in its various forms – can be supplemented by other forms of biomass, in a co-firing environment. Although there is increased sophistication required for the supply-chain and the fuel mix to be optimised, in some regional settings in PNG, this may be the only option to ensure sufficient supply to efficiently and optimally operate a biomass energy generation plant.

Useful discussion on this topic is supplied in the report, *Facilitating the Adoption of Biomass Co-firing for Power Generation*, produced for the Rural Industries Research & Development Corporation RIRDC).\(^{34}\)

In the PNG context, and particularly linked to the CPU concept, processing residues that do not have a higher-value output would be distributed to the biomass energy generator, supplemented by other strategically acquired feedstock. This could include:

- Shipped residues from other nearby wood processors
- Specifically contracted woody biomass collection
- Agricultural thinnings
- Alternative feedstocks in small quantities, including possibly some solid household and commercial waste (e.g. plastics)

### 6.1.4 Unique species marketing

Whether of sawn timber, or sliced veneer, PNG’s unique species are relatively sought after, but international markets are under-developed and anything but regular. Limited market development work has been conducted in the last

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decade, according to industry sources. By way of example, during field interviews, *IndustryEdge* was asked whether it could introduce a PNG sliced veneer producer to international market opportunities. The implication is that such markets do not currently exist, at least for that producer, and the pathway to access them is unclear.

**Potential solution:** establish, as an adjunct to the Central Processing Unit, a demonstration export market development program, focused on Australia, including professional development activities for industry participants.

### 6.2 Constraints
Inevitably, there are market constraints that make the extraction of increased value for wood resources quite challenging. However, identifying those market constraints is a beginning to addressing them. The following constraints, identified in the market analysis, are grouped around resource, manufacturing, export market access and geography, logistics and transport considerations.

Each of the constraints is supplied with a potential solution, all of which are tied together in 7.3 below.

#### 6.2.1 Resource constraints
Although it has an abundance of timber resources, PNG’s supplies of readily accessible resource is quite limited and has been assessed as declining. This is a constraint for the development of a sustainable domestic wood products industry.

This reportedly includes variable species and sizes of logs being harvested, which adds complexity and reduces productivity in processing facilities. It was suggested that this is becoming a more serious problem as the available wood resources decline and on average, are poorer quality than was previously the case.

However, the localised nature of the available resource may provide opportunities for smaller scale wood processing and value adding, concentrated on smaller local markets, especially within isolated regions.

Log segregation is a key skill and capability in any integrated operating environment. In some locations – including log receiving ports in China – some segregation occurs ‘in field’, with decisions made as to which facility particularly logs or groups of logs will be directed to. In other cases, the information required to make those decisions at the point the log is loaded, is supplied to the exporter.

**Potential solution:** improve log segregation for processing and focus attention on rotary peeling for veneer production to create plywood of various grades, for a wide variety of local applications.
6.2.2 Manufacturing constraints
There are several constraints on efficient manufacturing of wood products in PNG. These impact upon value adding opportunities, as well as the capacity to develop reliable markets, supplied by local capabilities. A number of these matters are further explored in the related work, produced in 2017, a Gap assessment of wood processing companies in PNG.35

Sub-scale manufacturing
Scale is defined globally. There are no world-scale wood processing operations in PNG, and none is likely. Scale is a primary driver of production efficiency and cost competitiveness. Facilities that operate at scale have sufficient resource and residues to maximise resource utilisation through both primary and secondary products.

Sub-scale facilities are more likely to strand residues without their value being extracted, less likely to leverage other services and be integrated within tight value chains.

By way of example of PNG’s sub-scale wood product manufacturing, a world scale plymill generally produces a minimum of 80,000 m³ of plywood per annum and up to 500,000 m³ per annum. Although it is a softwood mill – at scale these can be as much as double the size of their hardwood counterparts – the Pellos plymill’s (Finland) annual production is 480,000 m³ per annum.36

PNG’s largest plywood mill (Panakawa, Western Province), by contrast, has annual production capacity of 30,000 m³ per annum.37 By contrast, the newest plymill in Australia is considered to be relatively small, with an annual capacity of 48,000 m³ per annum, targeting a specific product range of the stable and well understood Australian market, and aiming to supply just 15% of the Australian market.38

Potential Solution: collaboration between producers to create scale, at least in terms of markets and potentially, in future manufacturing facilities

Energy

37 Rimbunan Hijau (PNG) Group, 2017 (interview)
38 Ta Ann Tasmania, 2015 (interviews and presentations)
PNG’s energy resources and network are fragile, spasmodic and reportedly expensive.

Although gas is clearly abundant and supplies have increased dramatically due to the energy resources boom, most of this resource is destined for export. The increased supply volume of energy, by type, is shown below.

**Chart 41: PNG Primary Energy Supply: 1990 – 2030 (MOTE)**

![Chart showing primary energy supply over time]

*Source: APEC Energy Demand and Supply Outlook – 4th Edition*

It is reported that the majority of industrial electricity is supplied by Hydro power, using facilities that in the main are 35 or more years old and have not been well maintained, with outages increasing.\(^{39}\)

There appears to be no formal utilisation of biomass as an energy source in PNG, although as outlined earlier, there is some thermal heat created by PNG’s wood products sector, and a new biomass electricity generator operating in Lae, producing 40 Megawatts of electricity, anticipated to expand to 80 Megawatts.

Inadequate, poor consistency and expensive energy is a constraint on increased and enhanced manufacturing and is a key point of inflection for investors, wherever the manufacturing requires thermal or electrical energy.

**Potential solution:** aggregate residues to a single location to value add through investment in biomass energy generation or develop smaller scale biomass energy production capacity

**Skills and productivity**

In interviews, industry identified insufficient skills as a constraint on more value added manufacturing. To some extent this is a chicken and egg issue. It is difficult to develop the skills to operate new equipment or work on new ways until those processes and systems are in place.

Generally, the ‘start-up curve’ for manufacturing is quite slow for this reason. Realism is required, with training and skills development opportunities ideally commencing when plant design and installation processes commence.

This is a lower level and entirely surmountable constraint.

**Potential solution:** evaluate and support wood processing training, possibly using vocational education and training infrastructure developed in Australia, applied through the TFTC in Lae

**Treatment of timber**

Major producers and stakeholders interviewed in this market analysis stated that the treatment of most of PNG’s timber resources, for most applications, is critical for the market and its further development. However, the cohort of mainly smaller operators – and some others – do not treat sawn timber, meaning buildings are far more likely to fail quickly, undermining the entire domestic market.

The suggestion was that recent developments seeing increased numbers of prefabricated, steel framed residential dwellings being imported (reportedly from China) and installed in Port Moresby, is partly a result of reputational issues associated with untreated timber.

**Potential solution:** establish cooperative marketing of PNG treated timber as a key element of ‘brand’ education and marketing AND support investment in timber treatment among smaller producers, seeking to create a premium price for treated timber, to encourage adoption of treatment on a wider basis
Stress grading and other engineering requirements

To secure their place in the built environment in PNG, wood products need to be stress graded and assessed for their engineering properties. This does not currently occur and is a constraint on the further development of markets for wood products in PNG and for EWP’s in international markets.

Potential solution: focus on all PNG wood products meeting engineering requirements, being tested, assessed and certified for purpose, potentially through expanding the linkages with the EWPA in Australia

6.2.3 Costs and problems of exporting

It is expensive and difficult to export from PNG. Field interviews and some subsequent comments leave no doubt that exporting wood products is – at its simplest – very difficult.

Wood products are currently and in the main, manufactured in local centres, close to wood resources. Products must then be shipped to port, which can be a matter of metres or hundreds of kilometres.

Wood products are typically then containerised, with the reported container shipping costs being very high. Container rental was reported as up to USD1,600 for a 40 foot container, with shipping costs to China (as a benchmark), currently quoted at USD1,829 per 40 foot container.\(^{40}\)

In addition to the costs of land transport, inspections and paperwork – or internal sea transport a landed price of something close to USD3,430 per 40 foot container is extremely high and potentially prohibitive.

The challenges of exporting from PNG include regulation and regulatory practice. A convoluted process of export approvals, involving multiple points of handling of approvals, constrains, rather than facilitates exports. It was estimated that the export approval process can take up to six weeks before an individual export licence is issued.

This would be tolerable if licences were issued prospectively, but they are issued on an instance-by-instance basis, requiring wood products manufacturers to submit continuously if they wish to export.

In addition to being cumbersome, one producer reported they had lost export sales and future opportunities while awaiting approval that was delayed, meaning they missed the ship their goods were intended to be on.

**Potential solution:** aggregate export volumes between producers to maximise leverage and coordination opportunities. Consider single desk marketing strategies, operated through the Central Processing Unit at Lae

### 6.2.4 Export market access

As outlined earlier, to the extent to which PNG’s wood resources have opportunities in international markets, with the exception of one or two larger producers, the sector is constrained by relatively poor knowledge of available markets and opportunities within them.

To compete in international markets, wood products must meet accepted standards and be delivered at comparable cost to competitor products.

Developing international markets requires effort, with countries typically aggregating producers in defined sectors to establish and market ‘brand identity’, seeking to leverage a mix of unique product characteristics (e.g. PNG’s timber species) and reliable supply capabilities, to add value to products.

It is not clear that this has occurred for PNG’s wood products sector, but with only small volumes of product available, it is likely to be necessary to establish some form of aggregation for export marketing, if not export sales in the future.

Discussed in other locations in this analysis, it is noted that certification, at least to the ‘Chain of Custody’ level, is required for access to sophisticated end-use markets.

**Potential solution:** establish a strategic export marketing development program, possibly as part of a single-desk marketing strategy

### 6.2.5 Geography, logistics & transport infrastructure

PNG’s population is spread far and wide, with only two significant population centres (Port Moresby and to a much lesser extent, Lae). This is challenging in itself, but the further constraint is that there is very little roading infrastructure and anecdotally much of what does exist is poor quality. There is no national road network, linking every place, and feasibly, there will be none. Sea transport is used for people as well as goods. This matter was addressed in the related work of February 2017, ‘Gap assessment of wood processing companies in PNG’.41

Despite Lae’s second city status, it is the primary port in PNG and is the major trading port in the country. In the context of PNG, it is a full-service port except

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for designated Heavy Duty freight and waste disposal services. Importantly, fuel is available.\textsuperscript{42}

Inevitably in this situation, manufacturing of wood products, especially those destined for end-uses in PNG, largely occurs close to the end market. Small local sawmills of various qualities and quantities of output are an example.

While this approach can ensure supply of materials where there is demand, it necessarily works against the development of scale manufacturing. It also limits the integration of manufacturing phases and types that could add value to PNG’s wood resources.

A further complication from geographic dispersal of manufacturing is that log segregation to ensure best possible utilisation does not occur in most of PNG. While segregation occurs at major log intake facilities, where wood resources can be turned into veneers and plywood or sawn timber of different sizes, then be treated or in some cases not treated, for specific end-use applications, the same does not occur in smaller manufacturing environments.

In those situations, the wood resource appears generally to be harvested and supplied, often rough sawn and untreated, into a market regardless of the best application.

This denudes the resource, the market and reportedly, the reputation of wood products as a reliable building material.

**Potential solution:** establish a single, integrated Central Processing Unit to optimise wood resource utilisation and value, located at or near a significant export facility – most likely the Port of Lae

### 6.2.6 Policy and regulatory challenges

Industry has identified a series of policy and regulatory challenges that need to be addressed to secure a higher value future for PNG’s wood products. These are detailed below.

**Export regulation and inefficiencies**

This item is detailed above at 6.2.3.

**Domestic processing policy uncertainty**

An announced policy that does not seem to have been operationalised requires that by 2020, domestic manufacturing industries be majority (51%) owned by

\textsuperscript{42}\url{http://www.pngports.com.pg/index.php/operations/port-information/64-lae-port}
PNG citizens. It is unclear what, if any, enforcement will be undertaken, however, industry advised that there was little prospect of any further investment until this policy is resolved and sovereign risk is removed from operations in the sector.

**Free Trade Agreements**

The impact of the ASEAN/APEC Free Trade Agreements (FTAs) will see import tariffs for plywood fall from 35% to 25% on the 1st January 2018. This will increase the competition for the local manufacturing sector, with no indication there has been any consideration of the impacts or impact mitigation.

### 6.3 Leveraged opportunities – a wood products and manufacturing hub

Opportunities to add value to PNG’s wood resources, and to establish, as part of improved value adding, a more robust EWP sector are limited by the factors outlined in this market analysis. To be successful, value adding needs to maximise the integration of volumes, commencing with wood resources (logs) and ending with optimum supply to end markets.

To meet the major market opportunities, especially the supply of sustainable and potentially pre-fabricated housing options, will require collaboration across the wood products supply chain.

Although export capable scale is unlikely to be achieved by a single business engaged in manufacturing wood products in PNG, the establishment of some form of hub or centralised operating facility could allow collaborations to develop in a manner that could vertically integrate a group of manufacturers so that export became achievable.

Skills development, and therefore training, is critical to the achievement of any integrated objective.

The PNG Timber & Forestry Training College (TFTC) is located in Lae. It is the sole forest industry training facility in PNG, albeit that its technologies and resources require renovation, replacement and strategic reconsideration to play a more effective role in a transformed industry.

The economics of stand-alone timber industry training facilities are notoriously challenging. When income can only be derived from selling training, facilities regularly fail. They typically require either or both of the following to succeed and thrive: ongoing government investment or commercial revenue from sale of
products. In that context, the draft ‘Proposed Business Plan for the Timber & Forestry Training College Central Processing Unit’ is noted.

There is an inevitable tension that must be reconciled for success to be achieved. A training centre might play a role in an integrated supply chain, but if it dominates any aspect of that supply chain, it will erode the commercial capacity or opportunity for one of its potential clients.

In this context, collaboration could involve the establishment of a wood products manufacturing hub or Central Processing Unit (CPU), located at or in near proximity to the TFTC, with the following features:

- **Shipment of logs by road or by sea to a centralised location**

- **Log segregation to best end-use and/or processing option at the CPU**
  As an alternative, logs could be broken down before transportation, to the point where they are roughsawn to specification, either for further sawing or as billets for veneer peeling. This option would require intense work on the supply chain and its capabilities, an activity for which the TFTC is uniquely suited.

- **Coordinated wood products manufacturing to meet specific end-use needs (e.g. housing)**
  Adopting a value-capture and market-oriented approach to the manufacture of wood products at the CPU will necessarily flow back to log segregation decision-making.
  
  The integrated elements would include, as a minimum:
  
  o Green sawmilling
  
  o Further processing operations (drying, dry milling and treatment) to produce dried and treated sawnwood products
  
  o Rotary peeled veneer line and driers
  
  o Sliced veneer lines and driers
  
  o Plywood production line.

- **Manufacturing of dwelling components for shipment throughout PNG**

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43 Yakuma, (2017), Proposed Business Plan for the Timber & Forestry Training College Central Processing Unit
Although not limited to any particular components, the essence of value capture involves extracting the highest possible value at the earliest possible date. The highest value dwelling components are likely to be:

- Mouldings
- Windows & doors
- Joinery
- Wood panelling.

**Manufacturing of pre-fabricated dwellings and other pre-fabricated buildings**

It should be noted that this very desirable level of value capture should be piloted before full-scale market establishment. It may be best suited to commencing only after successful component manufacturing detailed above and only in partnership with an established dwelling builder or responsible agency.

Support from government housing and development agencies could be critical to commercialising such a development but would be encouraged by government policies to enhance domestic processing and by the significant value-adding and manufacturing employment and economic activity arising from increased domestic dwelling and building construction.

**Aggregation of wood residues at the CPU to supply sufficient volume of resource to create thermal and electrical energy for use across the CPU**

See details at 6.1.3 above.

In addition, there are market-side opportunities that could enhance the commercial viability of a CPU, operating in concert with other processors in PNG:

**Co-marketing for domestic purposes, including branded marketing of a new ‘treated’ brand or similar, as recommended elsewhere in this analysis**

In the context of currently disaggregated domestic marketing, a small market and constraints created by the ‘standards free’ informal sector, co-marketing by major producers of a PNG specific treated timber ‘brand’ would be of assistance to build and maintain confidence in PNG’s timber products.
Such a development is rarely as simple as agreeing a brand and an advertising budget. Threshold to success of co-marketing endeavours is establishing or confirming and operating to a set of minimum standards that are applicable to all products, from all participants in the co-marketing activity. Those standards would ideally be consistent with International Standards and would meet domestic requirements for treated timber.

An example of this approach is the certification activity for plywood produced in PNG, which meets JASANZ standards, and is undertaken independently by EWPAA.

Properly supported and with the expertise of agencies like the EWPAA in Australia and the PNGFIA, a standards-based, treated timber brand and co-marketing exercise would have currency in its own right. Additionally, the assurance provided by such a brand would assist in marketing pre-fabricated dwellings and buildings, as set out above, including encouraging public and private sector investors.

- **Operation of a market development and access pilot program for exporting wood products to Australia**

Similar to the domestic co-marketing exercise outlined immediately above, an Australian based export market development pilot program for PNG’s wood products would have utility.

PNG’s relatively small product volumes dictate that international marketing pilots would focus on small and consistent volumes, to one or more close destinations. The emphasis will inevitably be on higher-value products. Typically, this would involve products that are not otherwise available in target countries.

Assuming the initial target is Australia, products of interest would include those set out at 5.4.1 (b) above. These include sliced veneers for furniture and high-end appearance grade products and timber mouldings and dowelling products. Products that should not be discounted include furniture products.

A market development pilot program is required to confirm market opportunities, establish relationships with potential partners/clients and determine specific requirements, prepare and test specific products. The requirements set out at 5.4.4 above need to be noted in this regard.

In many respects, this series of recommendations describes an integrated facility that could be operated by a single company, not merely headquartered at a central location. That is unlikely in PNG and from a policy point of view, may not
be desirable, noting the emphasis on what has been described as the ‘SME policy’, aiming to encourage the growth of small and medium enterprises, as well as the ‘Domestic Processing Policy’ which by 2020 is intended to ensure that 51% of each business is owned locally.

The enhancement of an established CPU would support existing operations and supply chains, while enhancing and supporting an emerging role for SMEs as part of an integrated entire operation. Small piece manufacturing of furniture and other ‘cottage’ activities is best supported by a close relationship with both suppliers and customers. This could include the development of skills and other capabilities required to enhance the value of wood resources in PNG.

A hub of this type would require infrastructure investment and ongoing support to establish and gain maturity. Acting as a key location, a hub of this type could also provide a focal point for further development, including of other integrated manufacturing solutions, such as those required to supply other forms of pre-fabricated buildings and structures.

6.4 Recommendations for further development activity

*IndustryEdge* considers that the following items could reasonably be pursued to seek to add value to PNG’s wood products:

1. **Establishment of a multi-user Central Processing Unit or hub, located within close proximity to the TFTC in Lae**

   The reality is that within PNG, either or both primary logs or wood products have to travel to market. It is preferable for the logs to travel and rational decisions be taken as to the best value utilisation of logs to occur where there is the widest range of options, including access to PNG’s main export facility.

2. **Increasing the focus on development of rotary peeled veneer and plywood production for local markets**

   Already growing, the market for EWPs – plywood at least – is dominating the PNG wood products market. The relative ease of production, versatility and ease of handling, including transportation suggests a focus on plywood for PNG’s built environment could be beneficial. Capital costs have reduced substantially over the last decade.

3. **Developing the dwelling component and pre-fabricated housing and other small buildings market**
Given PNG’s residential dwelling needs and the increase in the use of pre-fabricated (and partially pre-fabricated) dwellings, a collaboration between wood processors to establish sustainable capacity to supply this market, at least in main population centres could add significant value to PNG’s wood products.

4. **Enhancing the development of international markets for PNG’s wood products through the establishment of a market development and access pilot program**

PNG’s export market opportunities, including into Australia, are only likely to be optimised where they are concentrated on target markets and, in so far as is possible, aggregate supply to create consistency that may otherwise be beyond small producers. While desirable, it may be difficult to establish agreement on a ‘single-desk’ export marketing approach, at least for targeted, higher-value products.

Sliced veneers in particular, present an opportunity for establishing a ‘single-desk’ approach to export marketing into Australia.

To purchase something, a market needs to be aware of the availability and performance properties and opportunities presented by a product. Market development can be both time and resource consuming, especially where operated by small and independent firms competing with one another, instead of competing with substitute products.

Ideally, such a pilot would be supported over a number of years. Industry groups in Australia, including the EWPAA, Furniture Industry Association of Australia (FIAA) and the Australian Furniture Association (AFA) are typically interested in participating in these activities, and supporting their members to gain access to unique opportunities such as those presented by specific PNG wood products.

5. **Improving log transport infrastructure into the CPU, whether by road or by sea**

This is an important element in improving the efficiency – and potentially the capacity – of the CPU. Incremental improvements in the costs of moving large volumes of raw materials can contribute significantly to total operational cost reductions. As a minimum, this would allow the aggregation of a greater volume of material, from further afield.

6. **Establishing a co-marketing program for domestic applications, focused on treated wood products**
Developing a standards-based, co-marketing program for domestic application of PNG’s treated wood products would assist in overcoming the perception of poor performance of timber, relative to other building materials.

7. **Map and develop the required skills and capabilities for operation of each development activity and conduct training and skills development through the TFTC**

An enhanced and extended role for the TFTC at Lae will necessarily require additional skills and capabilities, in a range of areas. As logical extension is considered, skills and capability development needs also to be considered. It is noted that this is as applicable for the ‘systems’ and ‘market’ development sphere as it is at the ‘operational’ or ‘manufacturing’ sphere.
Appendices

Appendix One - References


Australian Bureau of Statistics (ABS), AHECC 4403.99.00


Jeremiah, H. (2017), Gap assessment of wood processing companies in PNG, Unitech


Othman, M (Prof. Dr) & Tahir, P. (Prof. Dr), (2014) Cost of Production and Energy Consumption in OPT Plywood Manufacturing Under Enhanced Processes on Prepreg Methods


P.J. Eddows, (2015), The Utilization of Papua New Guinea Timbers, PNG Forest Industries Association


UN Department of Economic & Social Affairs, (2017) *World Population Prospects: The 2017 Revision*


Yakuma, (2017) *Proposed Business Plan for the Timber & Forestry Training College Central Processing Unit*

**Appendix Two - Acknowledgements**

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