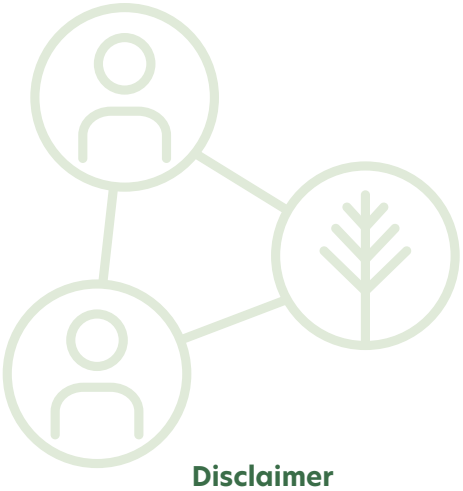
GIPPSLAND FORESTRY HUB
Promoting the Forestry Industry

# Innovation & Infrastructure


Understanding the barriers and opportunities for industry innovation in Gippsland and regional infrastructure gap analysis

Australian Government
Department of Agriculture, Water and the Environment

GREENWOOD STRATEGY



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**"...the industry needs to identify opportunities to innovate through the supply chain, and clarify and develop solutions to overcome barriers to innovation."**

# Executive summary

## Overview

The forest and wood products sector in Gippsland is facing a period of unprecedented change. In particular, the decision by the Victorian Government to cease native forest harvesting on publicly owned land presents a situation where the sector must find new ways to access fibre and optimise its recovery and application to wood products manufacturing, in order thrive. It also means that the sector must find new alternative sources of wood fibre if it is to maintain its current level of fibre input and manufactured wood output.

In order to achieve these outcomes, the industry needs to identify and address gaps in critical regional infrastructure. It also needs to identify opportunities to innovate through the supply chain, and clarify and develop solutions to overcome barriers to innovation.

## The fibre dilemma

The clearest challenge facing the sector in Gippsland is secure, reliable, long term access to wood fibre. The analysis presented in this report suggests that the wood fibre capacity of the region is seriously compromised. As a consequence of the Victorian Government's decision to cease native forest harvesting by 2030, over the next decade (or less) the available fibre resources within will reduce from approximately 2.3 million $m^3/y$ to 1.5 million $m^3/y$. That represents a 35% adverse change.

Under any of the forward outlooks modelled for this project, that remains the case until at least 2035. The more aggressive plantation expansion program indicates a potential uplift in volume from 2035. However, fibre production would not return to current levels until about 2055. It is also important to state that the lost fibre resource and its potential replacement are fundamentally different: naturally grown hardwoods between 80 and 100 years old compared to plantation grown softwoods which are approximately 30 years old. They are not interchangeable products.

There are some potential solutions to the fibre dilemma. The most obvious is to source fibre from other places. That is already happening, with processors in the region transporting fibre (in the form of logs, log by-products and sawn timber) from other parts of Victoria, other Australian states and overseas. However, this is currently occurring at relatively low volumes. The other obvious solution is to look at processes and systems which improve fibre recovery and utilisation, both in the forest and at the manufacturing stage.

## Innovation

Given the focus on fibre availability as a barrier to innovation, the innovation opportunities identified through this project are squarely focused on the front end of the supply chain. That is not to say that here are not opportunities to innovate further along the supply chain. But without fibre, that will become increasingly difficult.

The forestry sector broadly, and more specifically in Gippsland, has a strong record of innovation. However, it has been typically delivered at the enterprise level. The challenge presented is whether the forest and wood products sector in Gippsland can innovate across the sector and between sectors. The project has identified 12 focus areas for potential innovation:

- Gippsland as an innovation centre
- Supply chain collaboration
- Resource availability
- Harvesting and haulage systems
- Telecommunications and data
- Maximising fibre use
- Resource availability
- Technology and changed log attributes
- Manufacturing options
- Market access
- Social licence
- Integration of trees into farming systems

## Infrastructure

Gippsland is uniquely well placed with respect to infrastructure – roads, rail, ports and energy in particular. However, it also has some specific challenges.

Key gaps relate to both hard infrastructure (energy and telecommunications/data) and soft infrastructure (industry and cross industry networks). Key opportunities include capitalising on Gippsland's reasonably good road infrastructure, identifying and exploiting opportunities related to port infrastructure and improving energy and telecommunications/data performance.

The work undertaken for this project identified nine key focus areas for infrastructure:

- Policy and regulation
- Electricity
- Gippsland as an innovation centre
- Integration of trees into farming systems
- Telecommunications and data
- Supply chain collaboration
- Harvesting and haulage systems
- Social licence
- Resource availability

## Synthesis

The project has identified priorities based on addressing the synthesised challenges of:

- Secure and reliable access to fibre
- Digital communication
- Electricity
- Transport infrastructure
- Knowledge and people

A priority setting process was undertaken which identifies 11 focus areas and six recommendations for the Hub to consider:

**Recommendation 1: Industry collaboration**

The Hub to engage with Gippsland's forest and wood products sector to develop and formalise an industry collaborative business network with defined objectives to mandate and address:

1. Whole of industry engagement with local government decision-makers to improve planning and regulatory decision-making.
2. Actions to exploit emerging opportunities presented by the circular economy.
3. Opportunities to deliver whole of sector win-win process and systems innovations.
4. Specific social license issues which prevent development of the sector in Gippsland.

**Recommendation 2: Gippsland as an innovation centre**

The Hub to commission a detailed study to further develop a plan for the Gippsland industry to establish a forest and wood products innovation centre of national significance. The study is to consider similar examples in Australia and internationally. An important focus is how a Gippsland innovation centre would set itself apart from similar centres in other regions. Examples may include: advanced manufacturing; training and education; transport and logistics; data management and telecommunications.

**Recommendation 3: Embracing the digital economy**

The Hub to undertake a detailed study to identify telecommunications and digital economy opportunities and barriers. The study would also assess industry readiness and capacity to participate and develop an industry digital evolution strategy for Gippsland.

**Recommendation 4: Integrating trees with agricultural systems**

The Hub to commission a comprehensive evaluation and assessment of opportunities to foster integration of commercial forestry into traditional agricultural production systems. This project would leverage existing work focused on plantation capability and examine examples from Australia and internationally (e.g. New Zealand and Scandinavia) to develop an actionable strategy for Gippsland.

**Recommendation 5: Alternative fibre resources**

The Hub to commission a project to explore realistic opportunities to increase fibre availability from outside Gippsland. This will identify where potential fibre resources are located which could practically be imported to Gippsland and what commercial and infrastructure developments are required to achieve the increase.

**Recommendation 6: Industry manufacturing hub**

The Hub to commission a study to explore the opportunity to develop an industry manufacturing hub. The study is to explore opportunities to work efficiently with other sectors, exploit the circular economy, focus on product recycling and re-use, exploit systems to maximise fibre use and minimise supply chain costs, and link with the proposed Gippsland industry innovation centre.

# Introduction

## About the Hub

The Gippsland Regional Forestry Hub (the Hub) was established in 2020 and is funded by the Commonwealth Government as part of the National Forest Industries Plan: Growing a Better Australia – A Billion Trees for Jobs and Growth. The Hub is one of eleven similar entities located in key forestry regions throughout Australia.

The Hub's stated aims are to identify opportunities for a growing industry into the future to make the forest and forest products industry sustainable while supporting local and regional communities to thrive, improve public perceptions, support the community and raise awareness in the region of the career opportunities and employment pathways in the industry.

## Project rationale

The Hub has developed a 30 year strategy for Gippsland's forest and forest products industry to provide a clear and deliverable framework for ensuring that the industry is set up to meet these aims. The strategy is supported by an implementation plan which identifies specific projects and focus areas for the Hub's activities[1].

The strategy outlines four themes:

1. Fibre security for a thriving industry
2. Innovation for a world class, sustainable industry
3. A trusted and reliable source of information
4. Contributing meaningfully to Gippsland's community and economy

This report addresses two of the implementation objectives for Strategic Theme 2: Innovation for a world class, sustainable industry. The implementation plan provides the following additional context[2].

### Understanding the barriers and opportunities for industry innovation in Gippsland

Better utilisation of available wood fibre resources will ultimately rely on the introduction and adoption of new and emerging technology and innovation. In the context of the changing nature of the available fibre resource and potential medium-term challenges with accessing imported wood products, the role of emerging forestry and wood products technology and innovation could be significant in improving both the economics of growing wood and the ability for improved self-reliance on domestically grown timber.

[1] Greenwood Strategy (2021a)
[2] Greenwood Strategy (2021b)

Innovation barriers and opportunities occur at every point along the supply chain, from growing seedlings to manufacturing and supply of wood products to the market.

Developing a clearer picture of which points along the supply chain offer real future development opportunities for Gippsland is the first important step. It is then important to explore what those innovations and developments might look like in the Gippsland context and what are the opportunities for the industry as well as the barriers which need to be overcome to achieve these outcomes.

An important element of this is understanding and exploring cross-sectoral opportunities for innovation and technology development, given Gippsland's combination of geographic location (particularly proximity to Melbourne), infrastructure, and industrial and agricultural capability.

### Regional infrastructure gap analysis

Gippsland's economic and physical geography is quite different from other major forestry regions. This influences the way the supply chain works, particularly with respect to infrastructure.

The region has good infrastructure to the key market of Melbourne and also has a number of regional ports and regional rail infrastructure which are currently underutilised in relation to the forest and wood products sectors.

It is necessary to develop a clearer understanding of:

- The capacity and potential of existing regional infrastructure (ports, rail and roads).
- Who are the main supply chain and infrastructure actors in each of these infrastructure categories?
- Barriers to utilising rail and port infrastructure (for example rail and port access, costs, potential efficiencies, infrastructure integration requirements).
- Key export markets that could be serviced by these ports.
- The regulatory framework, barriers and challenges for infrastructure development.

### Project approach

The approach to addressing the project objectives has included the following elements:

- Extensive stakeholder consultation to understand industry and broader perspectives on innovation and infrastructure opportunities and barriers.
- Comprehensive review of available research and literature relevant to the topics of innovation and infrastructure for the forest and wood products sectors and for the Gippsland region.
- Regionally specific analysis to provide context about both current and potential future state with respect to wood supply and the forestry and wood products supply chain.
- Detailed assessment of opportunities with respect to both innovation and infrastructure.
- Synthesis of findings and development of actionable recommendations.

# Regional context

## Overview

In order to address barriers and opportunities for innovation and undertake an infrastructure gap analysis for the forest and wood products sectors in Gippsland, it is important to understand the regional context within which the industry operates.

There are several important elements to this:

1. Describing the current fibre supply and market situation and developing scenarios for potential future fibre supply and markets against an agreed baseline.
2. Understanding where fibre is currently originating and where it is transported to, both geographically and in terms of processing location and type.
3. Understanding where manufactured wood products are originating and being transported to.
4. Understanding which other industries and sectors are using infrastructure and why.

## Regional wood supply scenarios

An important starting point in relation to each of the themes of this project is to develop a clear picture of the baseline fibre supply arrangements and to describe potential future scenarios. Four potential future scenarios have been developed for this report.

### Data sources

***Productivity data from published sources***

The baseline scenario has been derived from data published by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). Modelled wood flows for plantation expansion, as presented in Scenarios 2 to 4 are based on yield tables published by ABARES. These are presented in Appendix 1.

***Limitations of forward wood supply forecasts***

The wood supply forecasts outlined in this chapter rely on the ABARES published estimates of plantation productivity at a regional level, for both hardwood and softwood plantations under various management regimes. Therefore, they can only be relied on to provide strategic insights about future plantation performance and potential wood flows. There are recognised limitations to the ABARES productivity estimates. In particular, it is important to note that the yield tables cannot be applied with any reliance to a specific site. Also, it is likely that they represent an overestimate of potential future plantation performance. This issue is discussed in more detail in Appendix 1.

## Scenario 1: Baseline supply

Under the baseline scenario it is assumed that harvesting of native forest on the public estate will step down in 2024-25 and cease by 2030 and that no significant new plantations will be established in the region. Figure 1 presents future wood flows under Scenario 1. Total available volume will decline rapidly from current levels of about 2.3 million $m^3$/y to a long term sustainable harvest level of under 1.5 million $m^3$/y. That decline is driven primarily by the transition out of public native forest harvesting, while the anticipated increase in softwood plantation volume (as the effects of the 2009 fire damage are resolved) somewhat compensates for the native forest volume reduction. It is important to note that if the native forest harvesting transition occurs sooner, as some stakeholders suggest, then the total regional volume could fall below 1.5 million $m^3$/y by 2025.

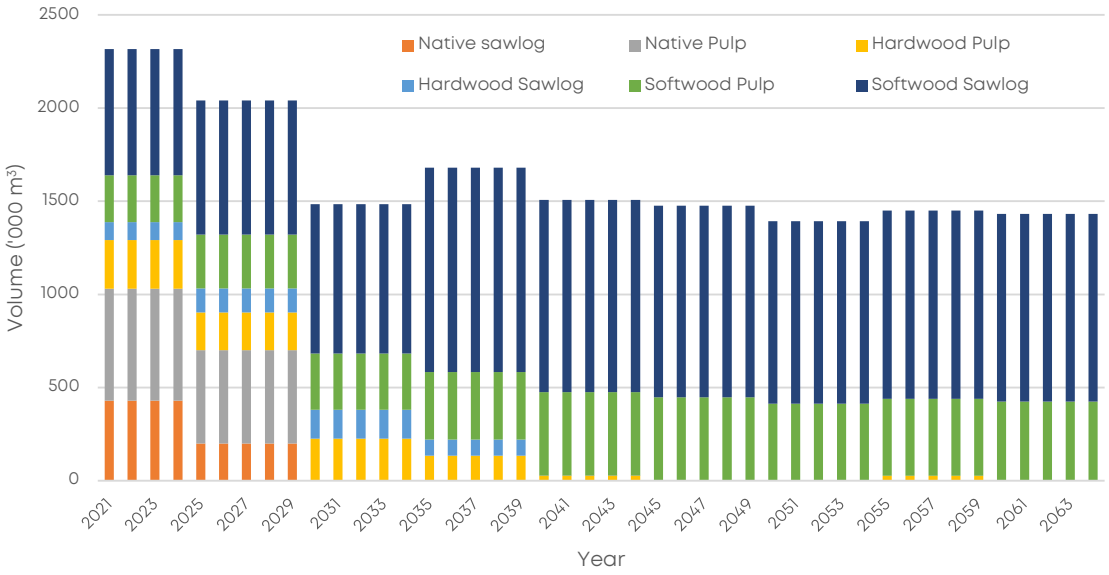



*Figure 1: Long term wood supply estimate – baseline scenario.*

## Scenario 2: Realistic plantation expansion

This scenario assumes that, under the Victorian Government's Gippsland Plantation Investment Program, the plantation estate will be expanded by 2,000 hectares, with new establishment commencing in 2024, at a rate of 200 hectares of new *Pinus radiata* plantations each year for ten years, as presented in Figure 2.

The context for this scenario is that the recent history of plantation expansion in Gippsland is limited, even during the Managed Investment Scheme expansion period. There are a number of reasons why this may have been the case, including high land costs, lack of suitable land for plantation establishment to preferred species, planning and regulatory complexities, and commercial realities, including the relative immaturity of Gippsland's wood fibre markets, which are dominated by one major buyer.

Scenario 2 makes no assumptions about the nature of the modelled plantation expansion apart from species selection and growth rate. For example, whether the additional 2,000 ha is established by existing larger growers or is integrated into other agricultural activity is not specified.

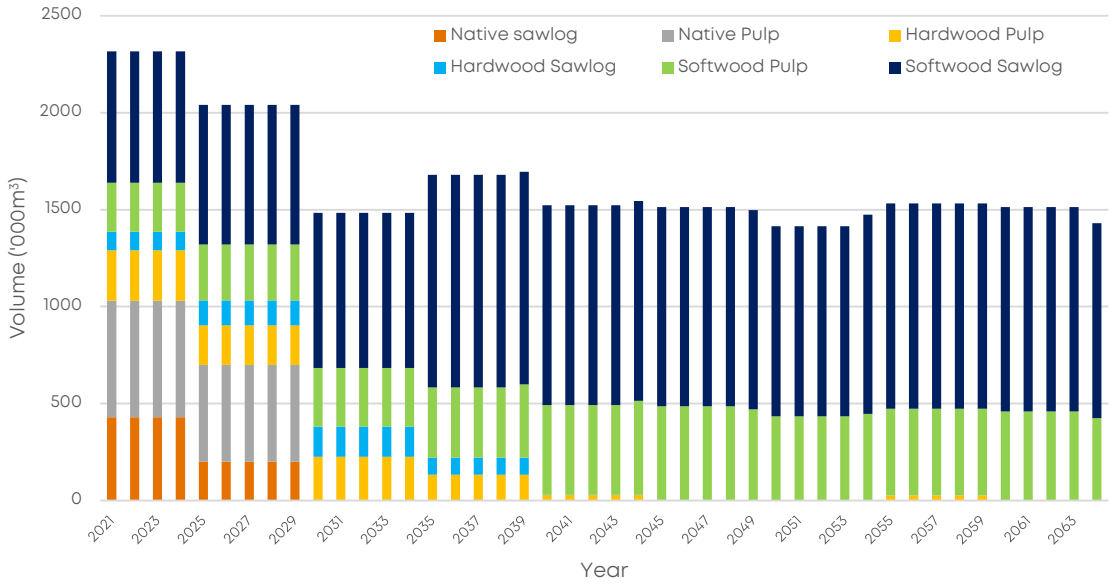



*Figure 2: Long term wood supply estimate – realistic plantation expansion.*

## Scenario 3: Aggressive plantation expansion and volume replacement

Scenario 3 assumes that, under the Victorian Government's Gippsland Plantation Investment Program, the plantation estate will be expanded by 50,000 hectares, with new establishment commencing in 2024, at a rate of 2,000 hectares of new *P. radiata* long rotation plantation and 500 hectares of new *Eucalyptus spp*. Short rotation plantation annually for 20 years.

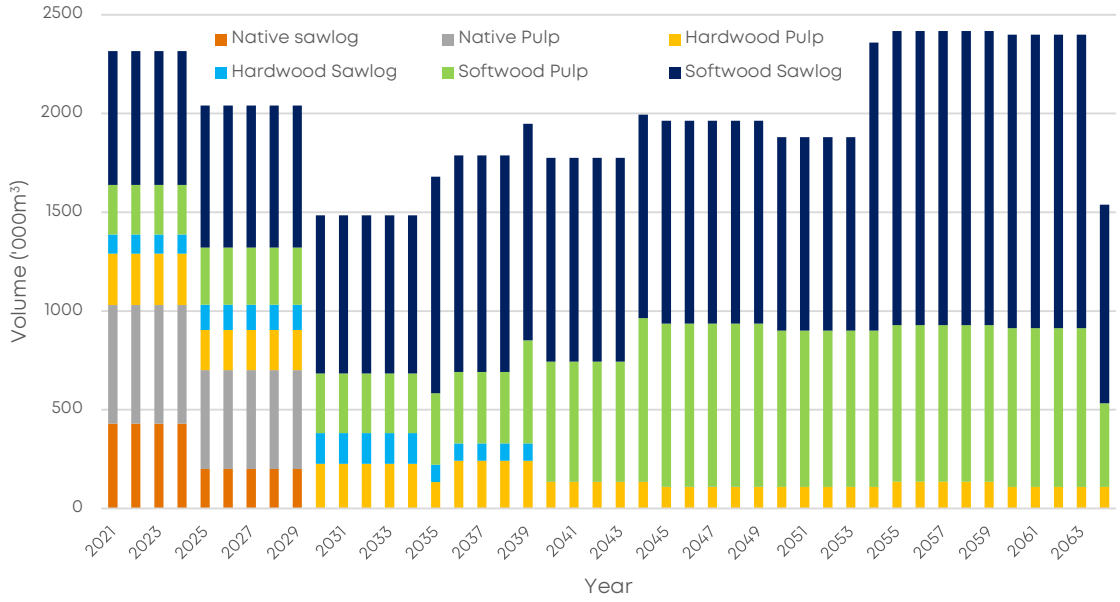



*Figure 3: Long term wood supply estimate – aggressive plantation expansion.*

It is important to note that the proposed plantation expansion under this scenario is highly unlikely to be achieved, given the availability and cost of suitable land in the region and the likelihood of substantial social license issues emerging if such a large-scale, rapid change in land use occurred. However, Scenario 3 does provide a clear picture about what investment and activity would be required in order to deliver longer term fibre production at equivalent volume levels to current production.

## Scenario 4: Hardwood product replacement

Scenario 4 looks at what would need to happen to replace the existing range of forest products, particularly those sourced from native forest harvesting operations (Figure 4). It assumes that 500 ha/y of hardwood plantations are established over a 20 year period (a total of 10,000 ha), commencing in 2024, and managed on a sawlog regime.

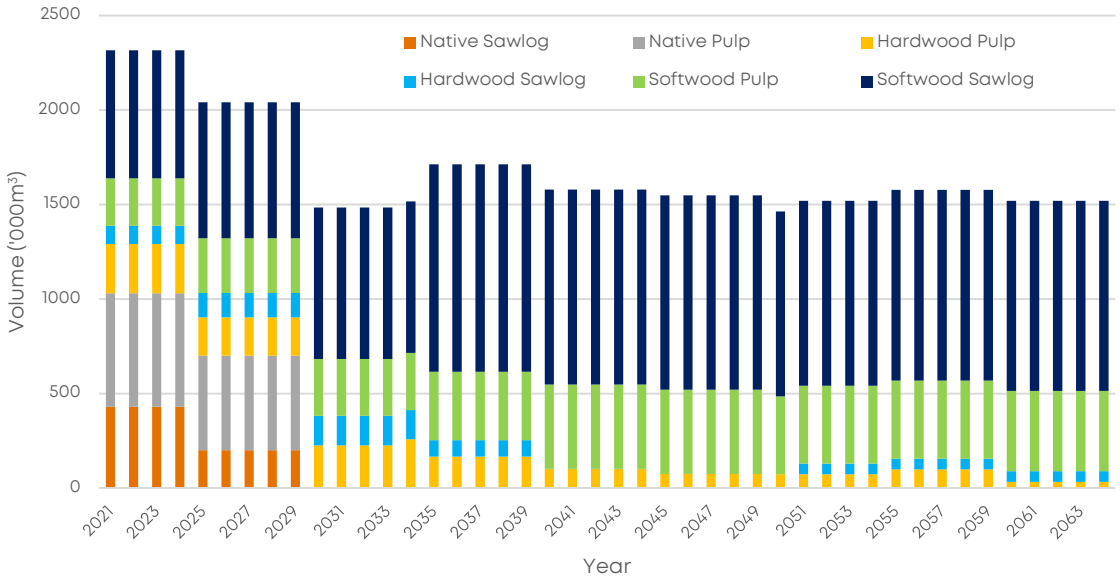



*Figure 4: Long term wood supply estimate - product replacement.*

Under this scenario, hardwood plantation sawlog production does not commence until about 2050 and the resulting volumes are about 10% of current native forest sawlog production.

## What do these scenarios mean?

The clear conclusion from the scenarios presented is that under any realistic forward estimate, the total availability of wood fibre grown in Gippsland will decline by about one-third from 2.3 million $m^3$/y to about 1.5 million $m^3$/y between now and 2030 and will remain at about that level for the long term. A more aggressive plantation expansion program, somewhere between what has been modelled in Scenarios 2 and 3, would deliver increased regional wood fibre production but this would not be realised for at least 15 to 20 years (first commercial thinning) and would not produce meaningful volumes of sawlog until about 2055.

On this basis, any consideration of opportunities and barriers to innovation and infrastructure development requirements should assume that the long term total availability of fibre from Gippsland forests will be in the order of 1.5 million $m^3$/y.

It is important to note that the assumed growth rates (based on ABARES data) which form the basis of these scenarios appear to be overestimated when compared with empirical research results for potential plantation productivity in Gippsland (further described in Appendix 1). Therefore, even the challenging scenarios presented in this analysis are likely to be over-optimistic with respect to future plantation fibre production from the region.

## Inter-regional wood supply

### Drivers for inter-regional wood supply

*Native hardwood*

Hardwood log supply chains have been extending (and rationalising) for a number of years as local forest supplies have contracted and smaller hardwood processors have become increasingly uncompetitive in traditional products and markets. Native forest supply chains were traditionally limited to relatively short haul distances, with sawmillers focused on and specialising in the processing of local timber species often with unique characteristics. The ongoing reduction in available native forest log supply has seen the number of sawmills decline, with processing increasingly centralised (in the case of Gippsland, to Heyfield and Bairnsdale) and the supply of input materials expanding to a range of hardwood species (not just eucalypts) from a much larger catchment (including Tasmania and the USA), and in a wide range of forms, including logs, flitches, cants and rough sawn boards.

*Plantation softwood*

In the past two years, Australia's softwood log supply chains have also undergone a dramatic change with respect to historic assumptions about economic haulage distance and, in the case of sawmilling, the type of logs which processors are willing to purchase. The reasons for this are complex and vary somewhat from region to region. However, they include:

1. The impact of the 2019/20 fires on short to medium term log availability, particularly in south-west NSW.
2. Historic over commitment of log supply in some key regions in southern Australia.
3. Liquidation of large areas of smaller privately owned plantation estates as a result of log exports to China. In some regions these plantations were considered discretionary sources of fibre by domestic processors. Therefore, when plantation owners were offered an opportunity outside the domestic market, the mature plantations were clearfelled and in many cases not replanted for a range of reasons. This has been a specific issue in Gippsland, as well as other parts of Victoria, Tasmania and southern NSW.
4. An evolution of the commercial approach to the cost of fibre which, particularly for larger scale operations, has seen a shift in focus from the cost of each discrete unit of fibre, to marginal costing and the weighted average cost of fibre. This has allowed greatly increased viable haulage distances and has been facilitated in part by truck configurations and back-loading.
5. Increased demand for structural building products in response to COVID-19 economic stimulus measures, leading to Australian processors operating at or close to capacity.
6. A significant reduction in construction material imports due to increased building activity in North America and Europe, as well as major disruptions to global supply chains, also both due to COVID-19.

### What constitutes an economic haul distance?

Until recently, a guiding rule of thumb for maximum economic haul distance of logs was a weighted average between 90 and 100 km from a processing facility. In some instances, larger processing facilities such as Visy at Tumut have been testing this assumption for decades, on the basis of being able to marginally price long-haul fibre due to scale.

However, since the beginning of 2020, in response to log supply constraints in some specific regions, there has been a substantial increase in long-haul inter-regional fibre movement, particularly for sawlogs. For example, Highland Pine Products and Borg at Oberon, as well as AKD at Tumut, are accessing sawlog and pulp log from Walcha in northern NSW and Stanthorpe in southern Queensland. Similarly, both Hyne at Tumbarumba and AKD at Colac are transporting sawlog from south-east South Australia. Some of these haulage distances are in excess of 800 km. In Gippsland, a number of processing stakeholders identified that they have transported native hardwood logs from NSW and Tasmania (as well as sawn flitches, cants and boards), Australian Sustainable Hardwoods (ASH) is transporting both logs from Tasmania and semi- sawn timber from North America and Europe. Similarly, a number of Australian frame and truss manufacturers are importing processed sawn timber from North America and Europe.

This shift has implications for innovation (e.g. in transport systems) and infrastructure (e.g. inter-regional transport links) which are further explored in this report.

### What types of log can be processed?

In the face of regional log supply constraints, Australian processors are becoming increasingly more flexible with respect to the log grades they are prepared to purchase. In particular, there is an increased focus on smaller diameter, shorter and poorer formed logs – that is, sawmills are willing to significantly relax log specifications around issues such as diameter, length and sweep.

This shift also has implications for innovation (for example, sawmilling systems to deal with sawn timber recovery from smaller logs, as well as truck configurations) which are further explored in this report.

### An emerging new paradigm

As a final observation, the scale of processing capacity continues to grow across the forest and wood products sector with business amalgamations (e.g. AKD and Pentarch growth through acquisition) and both vertical and horizontal integration occurring widely (e.g. Borg, New Forests and OFO Forests). Commensurate with this is the emergence of a new industry paradigm where the enterprise focus is not just on the economies of scale associated with access to input materials (specifically logs and residues) but also on the effective use of sophisticated multi-site and inter-regional logistics which opens up new propositions for the distribution of finished goods and semi-processed products. A clear demonstration of this new paradigm is the recent acquisition by the UK based James Jones Group of a 60% stake in Hyne[3].

[3] https://www.timberbiz.com.au/james-jones-uk-takes-majority-share-of-hyne-group/

## Gippsland's forest and wood products supply chain

Describing the forest and wood products supply chain in Gippsland provides further important context to the objectives of this report in relation to both infrastructure and innovation.

### Generic supply chain description

For the purpose of this report the forest and wood products industry can be considered to comprise three sectors, as presented in Figure 5, each with associated input and output transport networks of goods and services. Advanced manufacturing has been deliberately separated out from primary manufacturing because of its importance to the innovation discussion and to facilitate understanding of how logs and timber products move into and out of the Gippsland region.

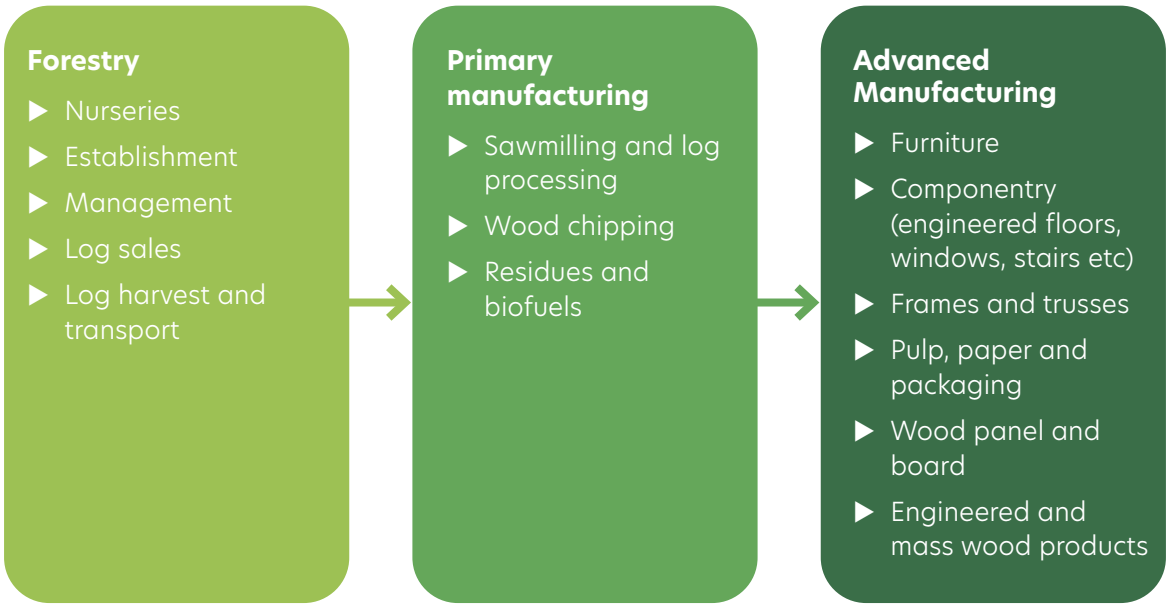



*Figure 5: Three sectors in the forest and wood products industry.*

### The difference between supply chain and value chain

It is also useful to understand the difference between the supply chain and the value chain (Surbhi, 2018). In this report we have focused on the supply chain approach, although the value chain is equally applicable in the innovation context.

#### *Supply chain*

The concept of the supply chain originates from operational management. It can be defined as the integration of all the activities, persons, and businesses through which a material or product is transferred and transformed from one place to another. It begins with a product request and ends when it reaches the customer, with the aim of achieving customer satisfaction. The supply chain is a tool of business transformation, which is utilised to minimise costs and maximise customer satisfaction by providing the right product at the right time at the right place and the right price.

*Value chain*

By contrast, the concept of the value chain originates in business management and is primarily concerned with achieving improved value and/or price for the material, product or service. It refers to the chain of activities that is employed to add value to a product at each step between origination and customer. The value chain is a tool of business profitability which is utilised to a competitive advantage while fulfilling customer requirements.

### Depicting Gippsland's forest and wood products supply chain

There are numerous resources available which depict the forest and wood products supply chain in general terms. Ferguson (1997, p.64) provides an excellent example for the Australian industry which is useful for describing the Gippsland industry supply chain in more detail. Figure 6 presents a view of the Gippsland supply chain in 2022. This diagram demonstrates how fibre processed in Gippsland primarily originates from within the region with some additional fibre imported from external suppliers. Locally processed wood products of various types are sold into local markets as well as to other domestic and international markets.

## How can the Gippsland sector increase access to fibre?

The description of Gippsland's supply chain serves to highlight the movement of timber resources within, into and out of the region. The analysis of current and potential future state with respect to fibre availability from within the region clearly demonstrates the challenges facing the sector. In combination, these discussion points raise the critical question of how the Gippsland industry can increase access to fibre resources? That question, and its solutions, have important implications for both infrastructure and innovation.

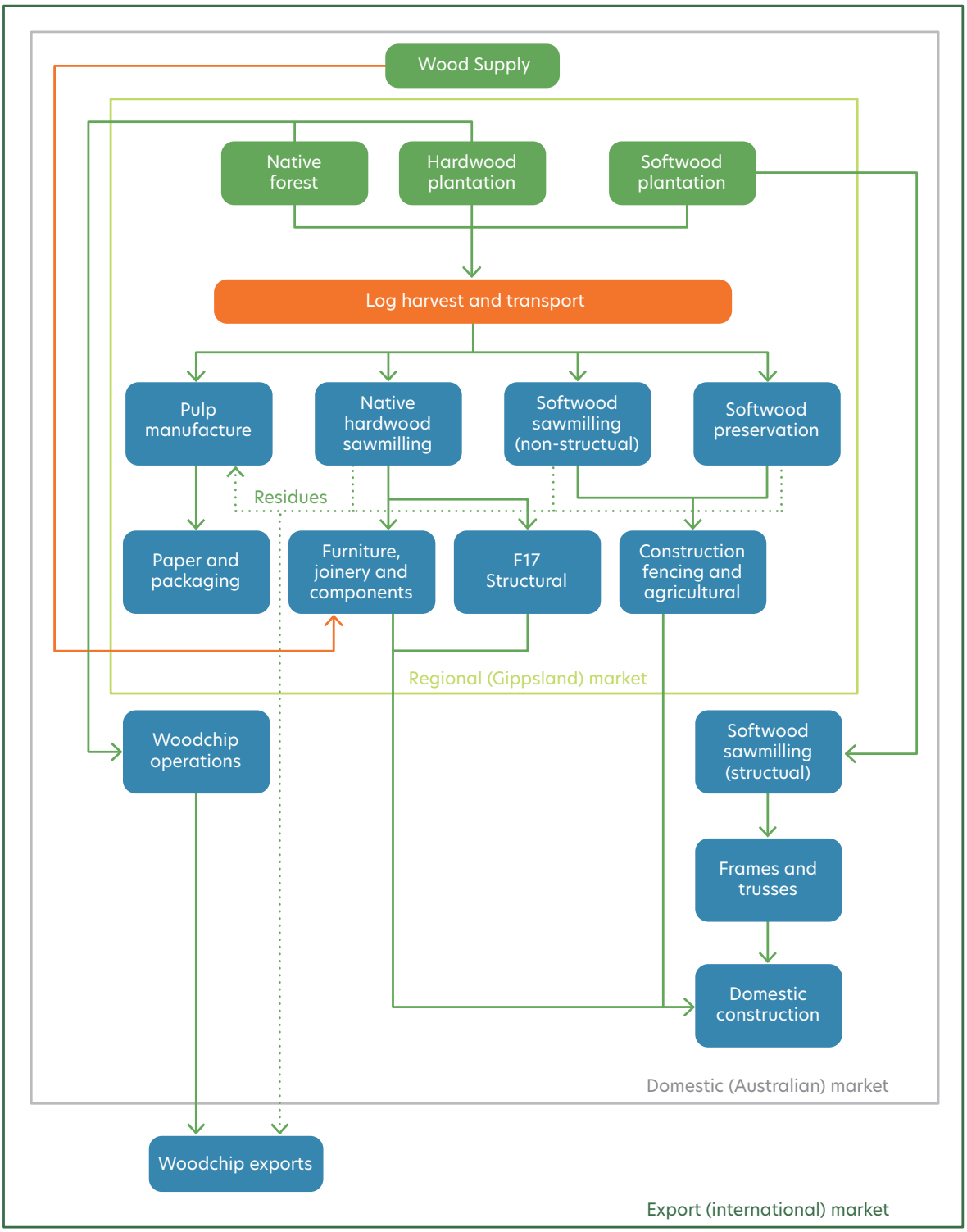



*Figure 6: Depiction of Gippsland's forest and wood products supply chain.*

**"Successful innovation can make use of any type of knowledge, that results in additional value and wealth."**

# Barriers and opportunities for industry innovation

## An understanding of innovation

### What is innovation?

There is a strong link between firm innovativeness and financial performance (Hansen & Breede, 2016, p.33 citing Kilic *et al*. 2015, Crespell & Hansen 2008, Välimäki *et al*. 2004) and it is therefore an often described intent of business strategy. The Business Council of Australia (BCA) defines innovation as '*the application of knowledge to create additional value and wealth*' (BCA, 2006, p.6). It can involve developing new ways to do things, such as changes to processes or creating more effective products and ideas. Therefore, '*a business can be innovative without actually inventing something new*'[4]. Examples of innovation are presented in Box 1. Innovative activities within businesses (BCA, 2006, p.6) include the following:

- Innovation does not necessarily involve technology and technological knowledge. Successful innovation can make use of any type of knowledge, that results in additional value and wealth.
- Innovation is not invention. It may not even require creation of new knowledge. It requires inspired application of knowledge (old or new) to create additional value.
- Innovation can be[5] changing a business model to adapt to changes in environment, or experimenting with marketing.

**Box 1: Examples of innovative activities (Hovgaard, *et al*, 2005, p.2)**

- New finishing techniques
- More efficient processing operations
- Product improvements through line extensions
- New uses of materials
- Changes in management structure and decision making
- Innovative methods to gather market information or sell products
- Innovative means of addressing environmental issues

[4] https://business.gov.au/change-and-growth/innovation/innovation-in-your-business accessed on 24/01/2022.
[5] https://business.gov.au/change-and-growth/innovation/innovation-in-your-business accessed on 24/01/2022.

Innovation is not static. Hovgaard, *et al*, (2005, p.4&5) citing Cooper (2001) suggests that we are entering a third generation of innovation processes which emphasises efficiency in time and allocation of development resources. This was characterised by Cooper (2001) with four fundamental F's:

- **Fluidity:** A process is adaptable with overlapping stages increasing development speed.
- **Fuzzy gates:** The process has conditional 'go' decisions that are situation dependent (e.g. projects may pass though gates without having completed all tasks).
- **Focused:** The process takes all projects into consideration and prioritises in order to focus resources on the 'best bets'.
- **Flexible:** The process is not a rigid stage-gate system, but allows each project to take its own course through a process.

## Types of innovations

Hovgaard, *et al*, (2005, p.2) define an innovative company as one that excels at one or more of '*product, process, and other*', when compared to others in an industry. North American forest sector companies '*have traditionally focused on manufacturing process innovations, but new products and new business systems can also be sources of competitive advantage*' (Hansen, 2016). To better understand innovation, Hansen (2016, citing Pisano, 2015) provides a useful matrix (business models and technical competency) within which to categorise innovation (see Figure 7). This provides a spectrum from 'routine innovation' (a company relying on existing technical competencies and business models) to 'architectural innovation' (employing new technical competencies and business models).

| | Leverage existing technical competencies | Requires new technical competencies |
|---|---|---|
| **Requires new business models** | **Disruptive:** A change in product outputs (manufactured) using the same technology (e.g. a glulam plant swapping to Cross Laminated Timber (CLT) production) | **Architectural:** A complete change in operations (e.g. swapping from manufacturing to retailing) |
| **Leverage existing business models** | **Routine:** A change included in the status quo (e.g. IKEA using certified wood) | **Radical:** An entity commences a new technology (e.g. builders swap from concrete to CLT) |

*Figure 7: A model of innovation based on Hansen (2016, citing Pisano, 2015).*

## Success in innovation

Citing Teece *et al*., (1997), Bull & Ferguson (2006, p.242) note that factors '*thought to influence firm success in environments of technological change*' include '*knowledge, capabilities, assets, competencies and learning*'. Bull & Ferguson (2006, p.746) explored innovation and defined market-pull, resource-push and technology push/market pull strategies for product development. Whether outcomes were successful or not (see Table 1) appears to be correlated to the type of strategy applied. In general, where product innovation was in response to market pull, success was more likely. Bull & Ferguson (2006, p.747) concluded that '*resource push innovations were less successful, at least in part, because of their limited relevance to the marketplace*'. Citing Cooper (1987), they note that this is well documented and that '*it is the market orientation and 'need' for the product which can be of extremely high importance in determining the level of success for the product*'.

This is an important consideration for the sector in Gippsland because it is problematic to focus on making best use of a resource in the absence of a targeted market need. In a North American context, a switch from processing old-growth logs to smaller diameter, second-growth material is an example of innovation (Hovgaard, *et al*, 2005, p.3). Industry made process improvements and offered new products (i.e. composites) based on the changing resource. Some changes relied on completely new technologies but most made use of adaptations (minor adjustments) in existing technologies to achieve processing and design improvements. While this is a potential opportunity for Gippsland, a caveat is that investment must be underpinned by resource security. As noted in Table 1, market pull innovations responded to demand for substitutes for large dimension timber (Bull & Ferguson, 2006, p.747). A key point is a requirement for an alternative resource on which to base innovations.

***Table 1: A summary of market-pull, resource-push and technology-push innovations identified by Bull & Ferguson (2006, p.746, Table 1)***

| Outcome | Product | Innovation type | Comment by entity exhibiting the attributes defined |
|---|---|---|---|
| **Successful innovation** | Innovation A | Market pull | *'There was a lot of imported Douglas Fir used for houses, in the US ... they started locking up the forests so there became a supply problem and quite often progressive reduction in quality problem which just allowed Innovation A to start to come into the market.'* |
| | Innovation B | Market pull | *'Hardwood has become more expensive. Douglas Fir has become harder to get. . . .out of North America there has been severe reductions in the forested area. Much of the more mature forest is no longer available so there was a shortage of those types of materials. Hardwood has largely suffered the same sort of fate and the cost has increased significantly.'* |
| | Innovation C | Technology push/ market pull | *'. . .what we were trying to do was reduce the volume of timber. The reason that we wanted to do that was because of the cost of timber.'* |
| **Unsuccessful innovation** | Innovation D | Resource push | *'It was to upgrade very low grade timber that had been sawn, air dried and at the time had very little market potential in its current form.'* |
| | Innovation E | Resource push | *'They were looking to find ways and means for expanding the use of wood that was coming out of the forest that was currently not being used'* |
| | Innovation F | Resource push | *'They needed to find a use for the thinnings from the forest; that was basically the small logs. One of the earlier trials showed that you couldn't economically cut the very small logs.'* |
| **Limbo innovations** | Innovation G | Technology push/ market pull | *'The initial reason for making the technology was to make Species X. Species X is quite a good timber but the main thing is that it is not hard enough, particularly for flooring. It is still quite soft. Basically you have to harden it; put something into it.'* |
| | Innovation H | Resource push | *'Initially it grew from environmental principles; local resources and also from utilising plantation hardwood they actually say that you can't grow hardwood for sawlogs from plantations. You just have to treat them a different way. That's the incentive.'* |
| | Innovation I | Market pull | *'The technology, because I immediately saw that there was potentially a massive market for it in Australia and because of the advantages that it can offer people and it was sort of within a lot of my core expertise.'* |

## An innovation strategy

An innovation strategy seeks to define and guide company evolution. A foundation is inherent innovativeness and Hansen & Breede (2016, p.33) citing Knowles *et al*. (2008) describe an '*innovative firm is one that has the propensity to create and/or adopt new products, processes or business systems, and ultimately, is better able to create or otherwise produce innovations*'. Hansen & Breede (2016, p.39 & 40) note that the most important factor in innovation is integration of business and innovation strategies and warns that without this approach, innovation efforts could become unfocused, reducing potential for success. This strategy involves constant management, monitoring and updating to ensure innovation opportunities remain focussed for the long-term. This is supported by analysis (Harnoss *et al*, 2019, p.1) concluding that innovative companies generate annual total shareholder returns on average 3.6% higher than those of their peers. Innovativeness is an element of company culture and achieving enhanced innovativeness may require cultural change which may prove highly challenging (Hansen & Breede, 2016, p.33). While information is available, industry can face challenges due to the format of the information; that is, it is based on other sectors (Hansen & Bull 2010, p.7).

Hansen (2016), citing Pisano (2015) noted that there are three questions to address in developing of an innovation strategy:

1. **Value:** How will innovation create value for potential customers?
2. **Capture**: How will a company capture a share of the value its innovations generate?
3. **Share:** What types of innovations will allow a company to create and capture value, and what resources should each type receive?

Addressing Pisano's third point, in developing an innovation strategy, Business Australia suggests a first consideration is whether outcomes are to be open or closed (see Box 2).

### Box 2: The nature of an innovation[6]

Open innovation means that you:

- Actively seek collaboration with external partners.
- Recognise that no business has all the expertise nor owns all the best ideas.
- Understand that solutions may already exist in other industries.

Closed innovation allows you to:

- Control all intellectual property and profit within your organisation.
- Maintain strong boundaries of a project.

[6] Accessed from https://business.gov.au/change-and-growth/innovation/develop-an-innovation-strategy on 24/01/2022.

## A history of innovation in the forestry sector

There is a long-term history of innovation in the native forest harvesting sector. As an example, the transition from hand-falling of trees to machine-based harvesting is a radical innovation. In regard to processing, operators have developed drying schedules for new species to avoid timber collapse (routine innovation). There have also been innovations in marketing. An example of this is development of the natural selection product lines in the 1990's (routine innovation). These are examples of a push for value-adding underpinned by innovation. A more recent example is the willingness to salvage wind-throw trees from the June 2021 storms for processing (routine innovation).

Gippsland's softwood sector evolved significantly from a focus on long-fibre pulpwood supply (in the 1970s) for pulp and paper production to a diversity of log types and associated products (radical innovation). With cessation of structural sawmilling in the region, this innovation has reduced substantially.

In general innovators have maintained business models while changing technology. An example of a disruptive innovation was Amcor's exit from plantation ownership by sale of those assets to institutional investors. While no longer in existence, PaperLinx was an example of architectural innovation where the entity switched from a focus on production to distribution. Hansen & Breede (2016, p.40) summarised that, through a forest sector example, *'...smaller operations navigating in an intensely competitive sector have the potential to experience significant success via innovation efforts'.*

## Knowledge base

### Knowledge and innovation

As noted above, knowledge alone does not guarantee innovation. While not a pre-requisite, innovation can include investment in research. Investment can be via formalised research vehicles (e.g. Forest and Wood Products Australia – FWPA; National Institute for Forest Products Innovation - NIFPI) or through investment by individual enterprises. For example, in the resource growing space, Heartwood Plantations undertakes internal research into un-proven species for plantations and ASH is undertaking a range of research and development activities into areas such as engineered wood products (EWP). Through investment in research and development, it is possible that a cottage industry could develop into a larger-scale industry. In support of industry, Gippsland has a range of technical centres such as Forestech TAFE delivering a range of courses, including Conservation and Land Management, Forestry, Timber Felling, Chainsaw Training and Machine Plant training[7].

### Knowledge brokers and technical transfer

There can be a cycle of lost innovations and re-inventing the wheel. This supports a need to protect knowledge by addressing how to capture and store it to keep it live. For example, in forestry there has been much knowledge lost (including hard drives and physical files) from past publicly funded entities due to a lack of focus on developing and implementing sunset clauses for its future storage and management. In many cases there was no mandated responsibility for maintaining this data.

There is a general lack of technology transfer in the industry which can support individual companies to innovate. Specifically, there is no capacity in state government agencies. To be effective, there is a need to understand the most effective methods for information transfer. A general comment is that for farming communities, peer to peer technical transfer is most appropriate. Formal mechanisms are possible and there are parties claiming such capacity. However, a point of caution is the general lack of detailed industry knowledge. The Hub can potentially fill this void as a knowledge broker, network developer and strategic facilitator.

[7] https://www.tafegippsland.edu.au/campuses/forestec_campus accessed on 22/12/2021.

## Implementation of innovation

### Requirements for confidence to innovate

Enterprise allocation of funds to innovation in the forest and wood products sector can be underpinned by a robust process of due diligence (see Cooper's four 'F's). There are generic issues, primarily relating to risk, underpinning confidence to innovate.

1. **Business structures:** Innovation within companies can be assisted by entity structure. For example, a board of directors and commercial structure allows a company to innovate.
2. **Log-quality:** A change in log quality either due to adjustment of log specifications, change in silviculture or genetics can change the volume of each product mix.
3. **Economies of scale:** Processors require economies of scale to be able to innovate, more so in a commodity market with softwoods.
4. **Financial security likelihood:** achievable margin and term of supply and service contracts.

### Enablers and barriers to innovation

There are specific issues associated with the hardwood processing sector.

- **Resource supply:** Investment in innovation requires confidence that underpinning resources will remain available in regard to quantity and quality. This can include long-term contracts. Historically this was delivered through 15 year timber licences. Later these were replaced by shorter term sales agreements delivered through competitive acquisition processes. With the decision to cease native forest harvesting on public land by 2030, with a risk of it occurring earlier, this is regarded as a primary barrier.
- **Government policy:** The existence of supportive Government policy provides confidence to innovate. Indeed it is more consistency and durability of policy that is critical.
- **Activism:** While legal resource supply underpinned by robust and consistent Government policy is possible, there has been a long history of activists influencing and changing the ability to harvest.

Gippsland's softwood processing sector, while utilising a different resource which is less subject to Government intervention, still requires resource certainty to encourage innovation. The issues include:

- **Resource security:** While softwood resources exist in Gippsland, certainty of access can be compromised. For example, export markets have soaked up surplus volumes given exporters' capacity to pay and low demand from domestic processors. While currently less of an issue, it remains as a driver of uncertainty.
- **Products:** There are a full range of softwood products, many of which are commodities (e.g. MGP).
- **Supply gap:** There is a current gap between supply and demand, exacerbated by a lack of plantation expansion. There is not enough softwood log resource to match processors' needs.

Regarding secure availability of wood fibre, there is a supply gap which will remain until any additional plantations are established and mature to production age. A general view among stakeholders is that fibre supply will be subdued for a very long time, as demonstrated in the scenario models (see the section titled **Regional wood supply scenarios**). A compounding barrier is the fibre demand of OPAL Australian Paper's Maryvale site, which will continue to require the majority of local supply. This ultimately has flow on effects for the Gippsland supply chain, including limited opportunities, and indeed incentive, to innovate. There is a Victorian Government focus on supply to Maryvale and long-term supply contracts in place with

Gippsland's major growers. A question therefore remains as to where does the balance of the processing sector fit? With such a focus, what is the incentive to innovate for other parties?

Ensuring consistent fibre supply to large scale operations in Gippsland is said by some stakeholders to result in timber being used in commercially sub-optimal ways. Further, many softwood processors have expressed a desire to expand their business. However as noted by the Inquiry into timber supply chain constraints in the Australian plantation sector, access to a stable supply of timber is not available to do so (Commonwealth of Australia, 2021, p.42, s.3.74).

There is a need for genuine investment partnerships to develop additional plantation resources. A challenge remains profitability of investment in trees, hence due to the scale necessary any party will require substantial funds. Further, differences in the nature of Government compared to private sector needs and behaviours could frustrate the innovation space. While there has been success in development of small-scale private plantings, such as historic joint ventures with APM Forests Pty Ltd (APMF), it is also the case that in some examples, end-user behaviour (including APMF) towards small growers has been a barrier to maintenance of current plantations and investment in new ones.

A current focus is on cost (particularly in log transport) with growers and processors reluctant to pay for contractors to maintain current state of a fleet, let alone to support any innovation. Indeed, a whole range of other service providers throughout the supply chain have similar and different drivers of confidence to innovate as well as other enablers and barriers.

## Transition methodology – development of innovation towards regional growth

Innovation is seen as more important than ever considering shorter product lifecycles, delivering long-term shareholder growth, and mature markets (Harnoss *et al*, 2019, p.1). There are formal processes available to facilitate development of projects and innovation. The first is the Smart Specialisation (SS) process developed by the European Union (EU) (see Box 3). The EU recognised that Europe was '*experiencing a period of momentous change. Globalisation, automation, decarbonisation, emerging and digital technologies: all have an impact on jobs, industrial sectors, business models, the economy and the society as a whole*' (EU, 2017, p.2).

The SS process recognises that '*...regions in industrial transition face specific challenges, notably where this is associated with a lack of an appropriate skills-base, high unit labour costs and deindustrialisation. These regions may be unable to attract sufficient extra-regional investment to encourage broad industrial modernisation or make full use of the opportunities*'.[8] Smart specialisation aims to boost growth and jobs, by enabling each region to identify and develop its own competitive advantages.

The process is a partnership and bottom-up approach, bringing together local authorities, academia, business spheres and civil society, working towards implementation of long-term growth strategies (EU, 2017, p.1). The following elements are included:

- **Smart:** Identify the region's own strengths and comparative assets.
- **Specialisation:** Prioritise research and innovation investment in competitive area.
- **Strategic:** Define a shared vision for regional innovation.

[8] https://ec.europa.eu/regional_policy/en/information/publications/factsheets/2018/pilot-action-regions-in-industrial-transition

**Box 3: A snapshot of Smart specialisation strategies (SSS or S3). (EU, 2017, p.3).**

Smart specialisation strategies are about enabling regions to turn their needs, strengths and competitive advantages into marketable goods and services. They aim to prioritise public research and innovation investments through a bottom-up approach for the economic transformation of regions, building on regional competitive advantages and facilitating market opportunities in new inter-regional and European value chains. They help regions to anticipate, plan and accompany their process of economic modernisation.

The Latrobe Valley Authority (LVA) is applying a 'Smart Specialisation Strategy' (S3) methodology through the University of Melbourne's Melbourne Sustainable Society Institute to bring together '*... government, business, research and education and civil society to co-design a shared vision for the region's future prosperity, environmental sustainability and social wellbeing*'.[9] The process of development of that vision is presented in Box 4, which includes quadruple helix stakeholder engagement[10]. Stakeholder engagement is voluntary, open, and with active dialogue, to identify the current position of all included parties, outline objectives and outcomes and identify how to achieve them. Parties included in the engagement can change but the process of engagement continues.[11] Food and Fibre Gippsland (F&FG) has partnered with the LVA to deliver a food and fibre stream of GS3. The GS3 approach of collaborative co-design '*...ensures that opportunities are assessed from multiple viewpoints, are backed by data, and have the support required to ensure their success*'.[12] The food and fibre stream is exploring the following opportunities:

1. Advanced Vegetable Processing
2. Carbon Economies
3. Circular Economies
4. Collective Craft Malting
5. Gippsland Trusted Provenance Trademark
6. Sustainable Emerging Commodities – Insects & Seaweed

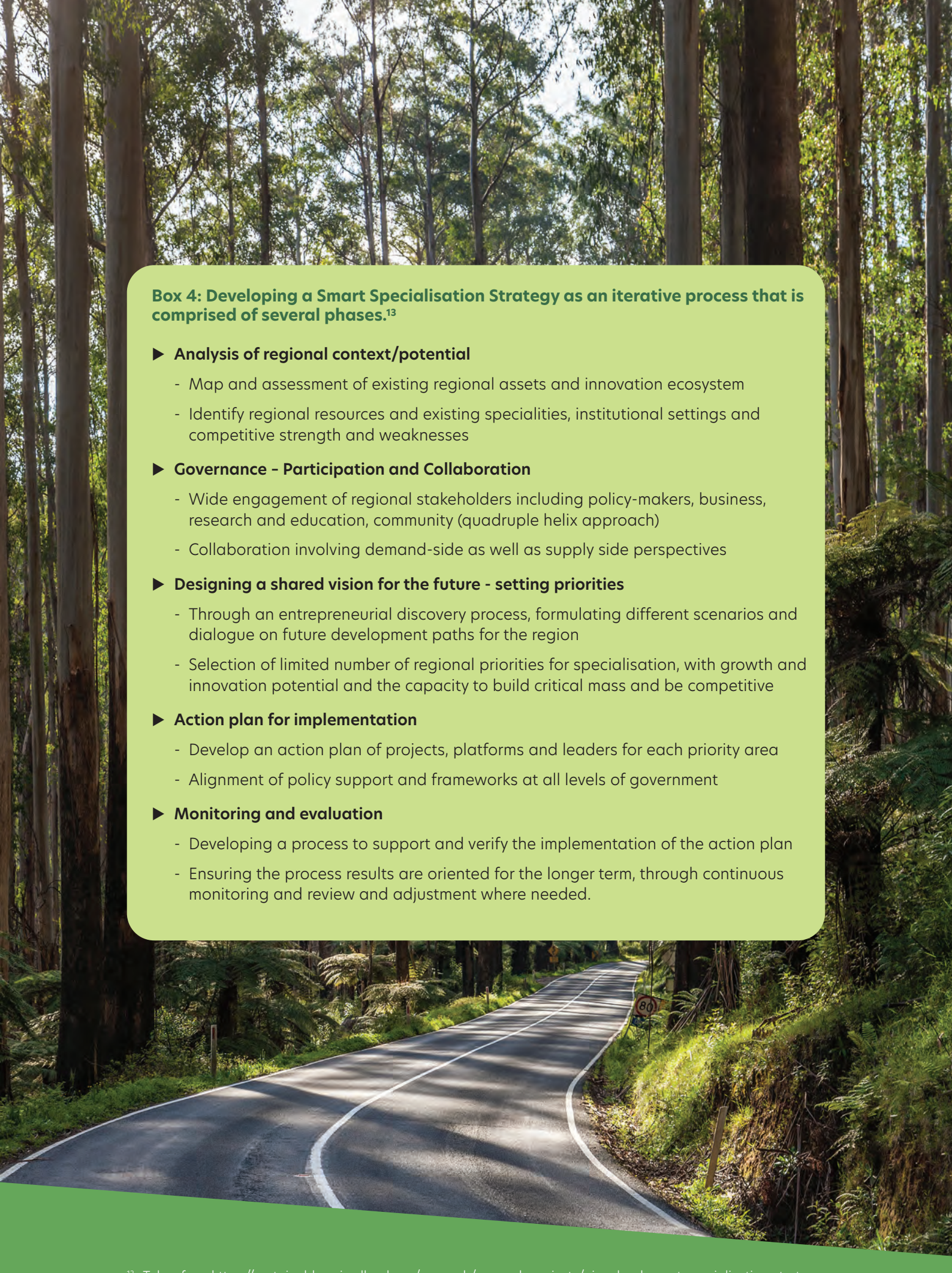
A review of a series of documents associated with GS3 found no effective mention of forestry, plantations or the timber industry in general (see Fastenrath & Goedegebuure, 2020; Anon, 2020; Goedegebuure *et al*., 2020). Given the scale of the forest and wood products sector and its importance to the Gippsland economy, this is somewhat surprising.

[9] Taken from https://sustainable.unimelb.edu.au/research/research-projects/gippsland-smart-specialisation-strategy on 22/12/2021.

[10] https://grrip.eu/why-is-quadruple-helix-engagement-so-important/ accessed on 2021/12/21.

[11] https://grrip.eu/why-is-quadruple-helix-engagement-so-important/ accessed on 2021/12/21.

[12] https://www.foodandfibregippsland.com.au/smart-specialisation accessed on 22/12/2021.



**Box 4: Developing a Smart Specialisation Strategy as an iterative process that is comprised of several phases.[13]**

- **Analysis of regional context/potential**
  - Map and assessment of existing regional assets and innovation ecosystem
  - Identify regional resources and existing specialities, institutional settings and competitive strength and weaknesses
- **Governance – Participation and Collaboration**
  - Wide engagement of regional stakeholders including policy-makers, business, research and education, community (quadruple helix approach)
  - Collaboration involving demand-side as well as supply side perspectives
- **Designing a shared vision for the future - setting priorities**
  - Through an entrepreneurial discovery process, formulating different scenarios and dialogue on future development paths for the region
  - Selection of limited number of regional priorities for specialisation, with growth and innovation potential and the capacity to build critical mass and be competitive
- **Action plan for implementation**
  - Develop an action plan of projects, platforms and leaders for each priority area
  - Alignment of policy support and frameworks at all levels of government
- **Monitoring and evaluation**
  - Developing a process to support and verify the implementation of the action plan
  - Ensuring the process results are oriented for the longer term, through continuous monitoring and review and adjustment where needed.

[13] Taken from https://sustainable.unimelb.edu.au/research/research-projects/gippsland-smart-specialisation-strategy on 22/12/2021.

## Innovation opportunities

### Defining target areas for innovation

As noted, innovation is as much about systems and processes as is it is about new technology or products. This is an important point. Following from consultation, an initial question remains as to what solution is innovation trying to provide? There is potential for a significant focus on the front-end of the supply chain (that is resource supply). An identified industry objective is secure, reliable, affordable access to the right fibre in the right place at the right time. Where this seeks to satisfy current markets, market pull will remain. However, given a greater chance at successful innovation in response to market pull, a push strategy with a new resource is more difficult (in the absence of market demand).

The stakeholder consultation documented a portfolio of potential innovations. In order to better understand potential innovations and their likelihood of success, classification is useful. The following categories have been used to classify each innovation opportunity identified and the results are presented in Table 2.

- **Focus of innovation:** Innovation can focus on best use of a resource push, work back from market needs pull or have a focus on technology push (Table 1). Resource and technology push can include cost and quality issues.
- **Scope:** Innovation can be held within an entity (closed) or be developed for a greater good (open) seeks that a collective benefit (see Box 2).
- **Typology:** As noted in Figure 7, there are four broad categories of innovation; routine, radical, disruptive or architectural. The two defining elements are;
  - **Business model:** As noted in Figure 7, innovation can make use of current or new business models.
  - **Technical competencies:** As noted in Figure 7, innovation can make use of current or new technologies.

### Observations

A key observation is that most identified innovations are resource push in nature. Where there is no linkage to a market, this reduces the likelihood of potential success. To be clear, linkages to a market can be a current market, with an entity simply seeking to maintain current supply of products (e.g. by seeking a fungible resource to maintain production). In a similar manner, seeking more efficient logistics for the same resource to supply the same processors to supply the same market is an innovation with a high chance of success.

*Table 2: A summary of innovation opportunities identified for Gippsland during consultation and literature review*

| Element | Focus | Scope | Business model | Technical competencies | Narrative |
|---|---|---|---|---|---|
| **Gippsland as an innovation centre** | Technology push | Open | New | Current | Gippsland has potential to host an innovation centre. Gippsland is heavily industrialised, with support services and willing municipalities (particularly Latrobe City). There is industrial land available in Gippsland with appropriately zoning. |
| | Technology push | Closed | Current | New | The addition of staff specifically dedicated to innovation could be a 'necessary ingredient for success' (Hansen & Breede, 2016, p.40). |
| | Technology push | Closed | Current | Current | A culture shift is required for most forest operations to one where the workforce sees innovation as part of its day-to-day efforts (Hansen & Breede, 2016, p.40). |
| | Technology push | Closed | New | New | New product and new business systems innovations can be sources of competitive advantage for the forest and wood products sector as well as traditionally focused manufacturing process innovations (Hansen 2015, p.1 citing Pisano, 2015). |
| **Supply chain collaboration** | Resource | Open | Current | New | Creation of a circular economy within Gippsland to maximise value at each point along the forest and wood products value chain, or throughout a product's life (KPMG, 2019, p.32). A circular economy seeks to close industrial loops and to turn outputs from one part of the value chain into inputs for another. This in turn reduces the consumption of virgin materials and the generation of waste. |
| | Resource push | Open | New | Current | There are process and systems innovation opportunities; for example, supply chain collaboration on key/shared issues such as roading, wood-flows and haulage systems addressed by a Softwoods Working Group. |
| | Resource push | Open | Current | Current | Addressing roading challenges and interface with local government to seek a holistic approach by addressing private and public roads in the network. |
| | Resource push | Open | Current | Current | A main focus is to maximise opportunities for optimised fibre use. Stakeholders suggest that this could include collaborative wood-flow planning; a challenge in Gippsland is industry structure with dominance by a few players. |

| Element | Focus | Scope | Business model | Technical competencies | Narrative |
|---|---|---|---|---|---|
| **Resource availability** | Resource push | Open | Current | Current | Specialist plantation expansion that aligns with existing plantation locations within the Gippsland Forestry Hub region. A recent plantation land suitability assessment noted that there is potentially an additional 27,754 ha of land open to plantation establishment. It is understood, however, that it would be quite difficult to achieve under current schedules (Spatial Vision, 2021, p.13). |
| | Resource push | Open | Current | Current | Fibre availability within the region is unlikely to increase within the next 30 years. Clear options exist to import fibre from other regions and overseas, as is already occurring to some extent. There is potential to more fully exploit existing port and other infrastructure to consider log and semi-processed imports from other Australian ports and potentially New Zealand. |
| **Harvesting & haulage systems** | Resource push | Closed | Current | Current | There is potential to explore looking at opportunities to double-shift harvesting equipment. This can optimise (reduce) capital investment but there is need to address regulatory and workplace culture issues. |
| | Resource push | Closed | Current | Current or new | Solutions for example are broad; innovation in haulage to enable back-loading and therefore make long haul fibre affordable and effective. |
| | Resource push | Closed | Current | Current | There is a need to make long-hauls of fibre efficient (defined by price and processing) including back-loading. |
| | Resource push | Closed | Current | New | There are opportunities to minimise haulage trips by improved haulage systems such as A-doubles. |
| **Telecommunications and data** | Resource push | Open | Current | New | There is broad recognition of opportunities to introduce telecommunications and data innovations in relation to delivering improved safety and logistics outcomes. There is recognition that Gippsland does supply chain logistics reasonably well (for example as an early mover on centralised despatch) but improved data availability could improve this. Examples of potential uses include live data from harvest heads for all players along the supply chain and real time safety monitoring of driver behaviour. |

| Element | Focus | Scope | Business model | Technical competencies | Narrative |
|---|---|---|---|---|---|
| | Resource push | Open | Current | New | Application of innovations in big data to support enhancement of logistics and systems processes; a barrier is telecommunications infrastructure. |
| **Maximising fibre use** | Resource push | Closed | Current | Current | Alternative harvest and haul systems as part of silvicultural regimes is a consideration. In the forest, in-field chipping to maximise access to resource by better recovery. |
| | Resource push | Closed | Current | Current | Development of an industry manufacturing hub concept with networked multi-use infrastructure (e.g. a sawmill at Maryvale to complement pulp and paper production). This would allow residues for on-site use as a by-product between one party and another. |
| | Resource push | Open | Current | New | Renewable energy and/or energy production derived from regional forest products as an opportunity for Gippsland to continue to grow the renewable energy sector and diversity the energy mix produced. (Note: recent literature predominately focused on wind and geothermal opportunities for the region). |
| **Technology & changed log attributes** | Technology push | Closed | Current | New | It is possible that in the future, logs will have smaller SEDs and be shorter lengths. There is potential for profit reinvestment to improve recovery of such logs with a robust pay-back time. |
| | Technology push | Closed | Current | Current | An enabling factor is that there is a need for changes to log specifications to address what is potentially available. |
| | Technology push | Closed | Current | New | Such an intent could be supported by increased use of artificial intelligence (AI) and automation; a significant driver is a general lack of available skilled labour. |
| | Technology push | Closed | Current | Current | An investment in sawmill capacity can be challenged by planning overlays (e.g. neighbours and noise) hence sawmills need to address this issue without breaching regulations. |
| | Market | Closed | New | New | New product and market development for higher value products that use residual material not currently utilised, including engineered wood and composite products (Commonwealth of Australia, 2021, p.68). |

| Element | Focus | Scope | Business model | Technical competencies | Narrative |
|---|---|---|---|---|---|
| **Manufacturing options** | Technology push or market | Closed | Current | Current | There is a need to consider manufacturing of composite and/or EWP. This can consider alternative fibre supply imported into Gippsland. An assessment is required of this opportunity. As an example, ASH is already progressing down this path. |
| | Market | Closed | Current | Current | An alternative is manufacturing of pallets, but supply of native forest hardwoods remains an issue. |
| | Technology push | Closed | Current | New | Combining a range of fibres, there is potential for hybrid composite beams and panels. |
| **Market access** | Market | Closed | Current | New | Emerging distribution channels, such as online direct-to-customer systems and regional online trading platforms (Goedegebuure *et al*. 2020, p.45). This could provide an opportunity to connect businesses with new markets, enable more efficient logistics and provide promotional benefits for local businesses. |
| | Market | Closed | Current | New | Such a platform could also assist in generating greater market intelligence through direct feedback loops between consumers and producers (Goedegebuure *et al*. 2020, p.45). Currently, there is reportedly a lack of accurate, reliable data that reflects the whole value chain (Goedegebuure *et al*. 2020, p.41). |
| **Social licence** | Resource push | Open | Current | Current or new | Social licence issues are important to assist with an increase in resources. For example, reduced chemical use as it relates to social license improvements and 'total land management'. |
| **Trees on farms** | Resource push | Closed | Current | Current | A realistic and objective assessment is required of the Scandinavian models of private forestry |
| | Resource push | Closed | Current | Current | Carbon storage initiatives, including the development of an Emissions Reduction Fund methodology for the plantation and farm forestry sectors (Commonwealth of Australia, 2021, p.vi). |

# Regional infrastructure gap analysis

## Aim of the gap analysis

The regional infrastructure gap analysis aims to determine:

- The capacity and potential of existing regional infrastructure (ports, rail and roads).
- Who are the main supply chain and infrastructure actors in each of these infrastructure categories?
- Barriers to utilising rail and port infrastructure (for example rail and port access, costs, potential efficiencies, infrastructure integration requirements).
- Key export markets that could be serviced by these ports.
- The regulatory framework, barriers and challenges for infrastructure development.

## What is infrastructure?

To provide context for this regional infrastructure gap analysis, it is important to define and describe what infrastructure is in relation to the forest and wood products sectors in Gippsland.

### Defining infrastructure

#### *Broad definition*

Infrastructure is '*...the basic physical and organisational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise*'[14]. A further definition is that infrastructure is '*...the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions*' and maintain the surrounding environment (Fulmer, 2009, p.32). In light of the transformations required to adapt to climate change, contemporary infrastructure conversations also frequently focus on sustainable development and green infrastructure.

#### *Infrastructure typology*

Infrastructure can be broadly classified into two types: hard infrastructure and soft infrastructure (see Table 3). Infrastructure is composed of a matrix of public and private physical structures within formal and informal settings (Dyer, *et al*., 2019, p.221) (see Table 4). This matrix is useful to investigate key support systems within a community that may inhibit or enable various developments and can represent a range of social, environmental and economic issues.

[14] Oxford English Dictionary, 2022. https://www.oed.com/

*Table 3: Hard versus soft infrastructure (La'o Hamutak, 2014, p.1)*

| Hard infrastructure | Soft infrastructure |
|---|---|
| Refers to physical networks necessary for functioning of a modern industry. This includes roads, railways, bridges, tunnels, water supply, sewers, electrical grids, and telecommunications (including Internet connectivity and broadband access). | Refers to institutions that maintain economic, health, social, environmental, and cultural standards of a country. This includes educational programs, official statistics, parks and recreational facilities, law enforcement agencies, and emergency services |

*Table 4: Infrastructure framework (Dyer, et al., 2019, p.221)*

| | Hard (physical) | | | Soft (organisational/relational) | | |
|---|---|---|---|---|---|---|
| | **Utilities** | **Environment** | **Buildings** | **Institutional** | **Community** | **Personal** |
| **Formal** | • Transportation (rail/road/air/sea)<br>• Water (sewage and wastewater)<br>• ICT<br>• Energy (power/gas) | • Civic space (streets, squares, etc)<br>• Public open space (parks, playgrounds, cemeteries, etc)<br>• Public 'private' space (business parks, etc) | • Public buildings (local authority offices, etc)<br>• Healthcare buildings<br>• Educational buildings<br>• Recreational buildings | • Government (national and local)<br>• Planning system<br>• Legal system including land ownership<br>• Health system<br>• Emergency services<br>• Educational and training system | • Residents association<br>• Neighbour-hood watch groups<br>• Business associations<br>• Landlords groups | • Employment<br>• Educational attainment |
| | **Urban Form** | | | | | |
| **Informal** | • 'Guerrilla urbanism' or 'urban hacking'<br>• Informal local drainage systems | • Natural / semi-natural urban space (rivers, seafronts, etc)<br>• Community gardens<br>• Semi-private open space<br>• Private space | • Commercial buildings<br>• Dwellings | • Sports and recreation organisations<br>• Arts and culture organisations<br>• Community development organisations | • Social networks (sports/ interest groups - bridging social capital)<br>• Informal community groups (linking social capital) | • Family and close friends (bonding social capital) |
| | **Hard (physical)** | | | **Soft (organisational/relational)** | | |

*Increasing softness and informality*

*Shared versus enterprise level infrastructure*

The ability of the Hub to identify, influence and address infrastructure issues at the enterprise level (i.e. behind the mill gate) is limited. Therefore, this project has focused on shared infrastructure, which is available and applicable to all sectors of a community. This includes transport networks, water and energy supply, telecommunications and institutional soft infrastructure (e.g. education). This approach is consistent with the legal definition of nationally significant infrastructure (see Box 5).

**Box 5: The Infrastructure Australia Act, 2008, s.3 definition of nationally significant infrastructure.**

The Act considers nationally significant infrastructure to include:

"...

a) transport infrastructure; and

b) energy infrastructure; and

c) communications infrastructure; and

d) water infrastructure;

in which investment or further investment will materially improve national productivity'

*Project focus*

This gap analysis has focused on hard infrastructure. However, although soft infrastructure is generally less transparent, it can be a potential enabling factor for innovative developments. Conversely, an absence of soft infrastructure can be a barrier to innovation. Therefore, soft infrastructure identified with direct relevance to this project has been described and addressed.

## Overview of Gippsland infrastructure

A range of infrastructure networks combine to support the forest and wood products industry in Gippsland. Commercial forests are managed primarily for the production of wood which must be harvested and transported from the stump to a processor or point of export, and then transported to a market. This is a fundamental principle of forestry. Except for some issues inside private property boundaries, almost all infrastructure required for a thriving forest and wood products industry is the same as that required for a thriving local economy and wider community. Inevitably interest in and use of shared infrastructure can be challenging or complementary. Figure 8 provides an overview of the region's key infrastructure.

Gippsland has been the focus of considerable government and industry attention regarding its economic future generally and role of the region's infrastructure in supporting that. Reports have been prepared over the past two decades, reflecting that Gippsland's economy is in a state of transition across a number of social, economic and industrial fronts. The Victorian Government's infrastructure strategy (2021-2051) identifies 94 recommendations specific to Gippsland's future infrastructure requirements (Infrastructure Victoria, 2021, pp 05-15). These recommendations are categorised into three strategic focus areas summarised in Table 5 Those with direct relevance for this project are highlighted in green. The focus areas identified are consistent with the core themes identified through the review of literature and stakeholder consultation undertaken for this project which are summarised in Box 6.


## Energy

- Operational wind farm
- Power station
- Longford gas plant
- Coal mine and environs
- Gas reserve
- Oil reserve
- Gas pipeline
- Oil pipeline
- Gas/Oil pipeline
- Other pipeline
- Electricity transmission line (500kV)
- Basslink (500 kV)

## Transport

- RAAF Base East Sale
- Airport
- Aerodrome
- Port
- Potential internodal freight terminal
- Highway
- Artierial road
- Traralgon bypass acquisition corridor
- Active railway line and station

## Features

- Settlement
- Hospital
- University
- TAFE
- Existing urban land
- Melbourne's urban area
- Victorian Desalination Plant
- Designated water supply
- Lakes
- Public land

*Figure 8: Gippsland Regional infrastructure overview (State of Victoria, 2014, p.20, Map 5).*

*Table 5: Victorian Government's infrastructure priorities for Gippsland (2021-2051) (summarised from Infrastructure Victoria, 2021, pp 05-15)*

| Strategic focus | Objective | Recommendation focus |
|---|---|---|
| **Enhance regional market access and economic growth** | Unlock industry growth opportunities | Removing energy infrastructure barriers |
| | Foster regional tourism | Recovering regional tourism |
| | Enhance water security and industry resilience | Water security for agriculture |
| | Improve freight networks | Improve freight networks |
| | Managing Gippsland's coasts | Protection from climate change |
| | Facilitate recycling and resource recovery infrastructure | Facilitate regional recycling industries |
| **Better connect the regions** | Redesign public transport | Enable viable transport options |
| | Strengthen communications and digital connectivity | Improve digital connectivity |
| **Foster regional Victorian's health, safety and inclusion** | Improve access to healthcare | Improve health outcomes for Gippsland residents |
| | Improve and better use community and council infrastructure | Better use community infrastructure |
| | Address social housing challenges | Enhance access to affordable, fit for purpose housing |

**Box 6: Key infrastructure themes for Gippsland from stakeholder consultation and literature review**

- Reliable and affordable access to electricity.
- Reliable telecommunications coverage to address safety and data transfer requirements.
- Road infrastructure is generally good but there are localised issues and increasing congestion.
- Rail is only a solution for commodity scale production; otherwise it is too costly and cumbersome.
- Port infrastructure is currently underutilised and not well linked with other infrastructure or industry.
- Education and training, research and development are important as a strength and an opportunity.
- Government policy and processes (e.g. native forest harvesting, transition processes and permit approvals processes) are a barrier.
- Extension and specialist support services to small scale forestry and wood processing businesses.
- Local business and community engagement networks.

## Transport infrastructure

Figure 9 presents an overview of Gippsland's key transport linkages (State of Victoria, 2014, p.11, Map 4). The Victorian Government's 2014 *Gippsland Regional Growth Plan* (State of Victoria, 2014, p.10) notes the following strategic elements in relation to Gippsland's transport infrastructure:

- Transport links are largely east-west oriented. The Princes Highway and Bairnsdale rail line connect major settlements.
- North-south movement is via the South Gippsland, Bass and Strzelecki highways.
- Rail transport (passenger and freight) links to Melbourne and its ports.
- Investment in the Port of Hastings (commercial freight capacity) is considered by stakeholders to be a major potential driver for regional growth. This requires upgrades to rail and road connections and planning for future transport corridors.
- The region has important economic connections and linkages to export ports in Melbourne and New South Wales.
- Export of agricultural, timber and paper products to national and export markets generates significant value for the region and underlines the importance of reliable access to markets.

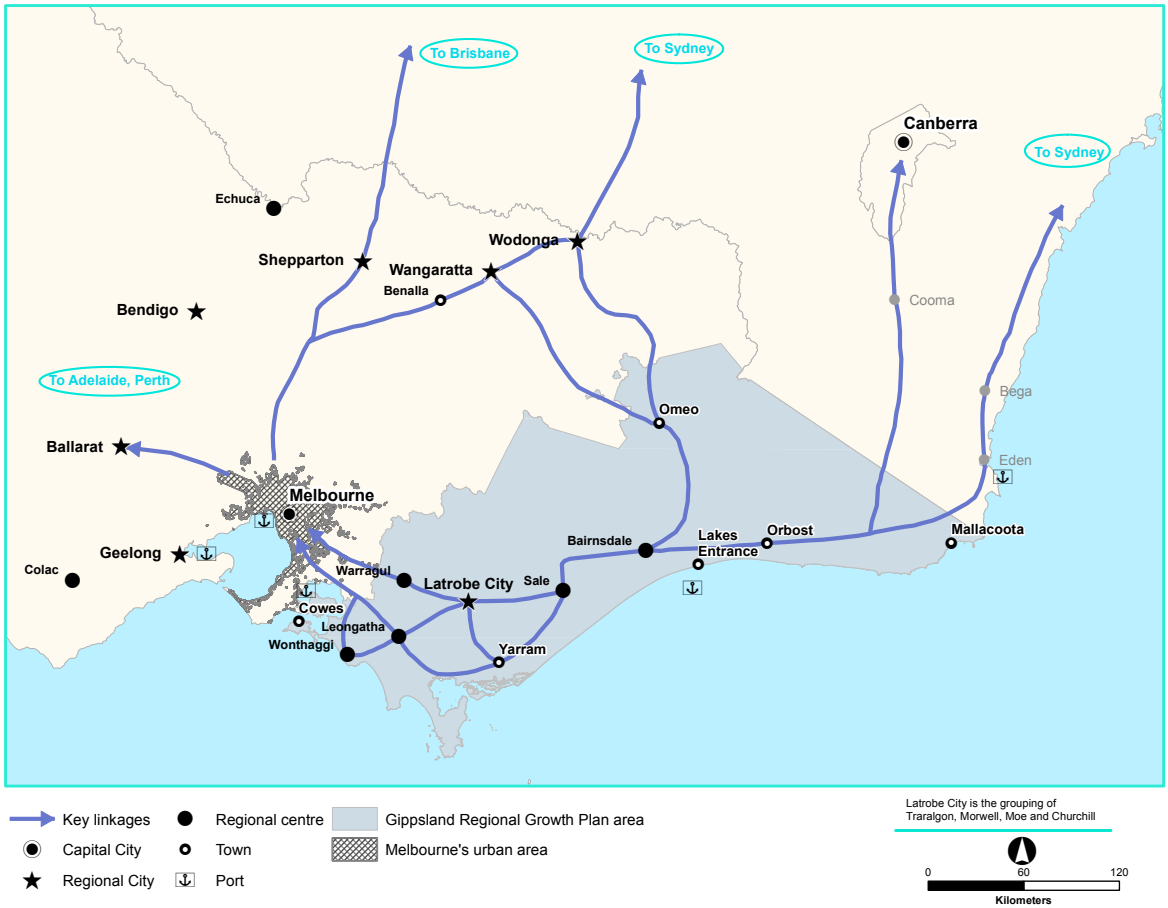



*Figure 9: Key transport linkages for Gippsland (State of Victoria, 2014, p.11, Map 4).*

*Roads*

## Overview

The Victorian network of public and private roads is managed by different coordinating and responsible authorities (see Table 6). Transport from the forest is by road, therefore road infrastructure (including bridges) is of primary importance to the forest and wood products industry. Typically road infrastructure is used to transport products from the primary processor to the next supply chain location, which may be a further value add processor, an export facility, or an end user market place. Road infrastructure is generally considered by stakeholders consulted to be of a relatively high standard in Gippsland when compared to similar forestry regions in Australia. Stakeholders identified a number of localised road infrastructure issues which, if solved, would assist general timber industry traffic flow, reduce road maintenance costs and improve general community safety outcomes. A more pressing concern for stakeholders is a perceived inconsistent approach among the various responsible authorities in relation to management of timber industry use of roads, particularly when compared to other road using groups.

***Table 6: Road types and responsible authorities in Victoria (VicRoads, Victoria's Road Network[15])***

| Road type | Coordinating road authority | Responsible road authority |
|---|---|---|
| **Freeway (except privately operated)** | VicRoads | VicRoads |
| **Freeway (privately operated)** | Varies | Melbourne CityLink – Transurban<br>Eastlink – ConnectEast<br>Peninsula Link – Southern Way |
| **Arterial (urban)** | VicRoads | VicRoads (through traffic)<br>Council (service roads, pathways, roadside) |
| **Arterial (non-urban)** | VicRoads | VicRoads<br>Council (service roads, pathways) |
| **Municipal** | Council | Council |
| **Non-arterial State** | e.g. DEWLP. Parks Victoria (VicRoads for a small number of these roads) | e.g. DEWLP. Parks Victoria (VicRoads for a small number of these roads) |

## Previous work

The Timber Industry Road Evaluation Study (TIRES) undertaken across Victoria for the period 2016 to 2020 (Timber Towns Victoria, 2016, p.03) identified almost $3 million in required expenditure for five priority road projects to improve road infrastructure outcomes for the forest and wood products sector in Gippsland (see Table 7). The report notes that Gippsland's road need are significant due to year-round supply to major processors in the region and because of the location of some plantations in steep terrain with relatively high rainfall. Therefore a key focus is the provision of all-weather roads, as well as bridges and culverts to deal with waterway crossings.

[15] https://www.vicroads.vic.gov.au/traffic-and-road-use/road-network-and-performance/victorias-road-network accessed on 22/02/2022.

*Table 7: Top five priority road projects for Gippsland, TIRES report 2016 (Timber Towns Victoria, 2016, p. 03)*

| Road name | Municipality | Road project | Estimated cost (2016) |
|---|---|---|---|
| Taylors Rd | Wellington | Construction | $542,000 |
| Ferguson Rd/ Willowgrove Rd Intersection Fumina | Baw Baw | Intersection improvement to improve limited sight distance to allow safer access to Willowgrove Rd | $137,000 |
| Grand Ridge Rd | Latrobe | Widening of approximately 15 corners to improve public safety. Some corners currently impassable to log trucks. | $930,000 |
| Whitelaws Track | Wellington | Resurfacing on all shaded corners with material suitable for wet weather haulage to address previous unsuitable surfacing. | $450,000 |
| Gormandale Stradbroke Rd/ Taylors Lane | Wellington | Resurfacing due to difficulty for trucks climbing the hill on Taylors Lane in all weather conditions. Is the shortest route between the plantation and Maryvale. | $900,000 |

## Current issues

While consultation identified a general level of satisfaction with Gippsland's road infrastructure, there were a several areas identified that warrant further consideration for this gap analysis. A number of specific observations were made by stakeholders relevant to the road infrastructure situation in Gippsland currently. These include:

1. **Industry contributions to road infrastructure:** the Gippsland forest and wood products sector has funded and constructed a range of roads which have subsequently been adopted for broader community use. Examples include the Tamboritha Road (from Licola to near Surveyor's Creek), the Brodribb Road in East Gippsland as well as many upgrades to arterial roads that are used by the general public.
2. **Specific potential road improvements:** including consideration of dual carriageway for the Hyland Hwy and realignment of specific intersections to improve traffic flow and road safety.
3. **Improved corridor access:** two specific corridor opportunities have been identified. The first is the road transport link between South Gippsland and the Latrobe Valley; the second is the recognised challenge of road freight from Gippsland getting across the Yarra River in Melbourne with either logs or finished products.

## Policy and regulation

An important focus for stakeholders is the challenge of delivering improved road infrastructure outcomes in the context of the complex policy and regulatory environment that operates in Victoria. As outlined in Table 6, responsibility for public road infrastructure is covered by multiple agencies and authorities. In addition, the approvals process for road infrastructure on private property is managed inconsistently between local government authorities. At least one stakeholder identified this issue as a barrier to investment in trees on agricultural land because proponents cannot guarantee access to the asset at harvest time.

An emerging issue, which has attracted some media attention recently, is the apparent lack of intent to invest in improving the quality of Victoria's (and therefore Gippsland's) non-arterial rural and regional road network. The issue has emerged from the State Government's response to the Victorian Parliamentary Inquiry into the Increase in Victoria's Road Toll (Legislative Council, Economic and Infrastructure Committee, 2021, p.51). The Inquiry identified the role of sub-standard rural and regional roads to poor road safety outcomes to which the Government has responded by considering broad reductions in speed limits to 80km/hr or less across Victoria. The criticisms include that this response will be limiting to economic development and does nothing to improve the quality of roads and, therefore, the ability of rural and regional industries to improve both economic and safety outcomes by applying improved and more efficient transport technology

***Ports***

Traditionally, Gippsland forest and wood products transported by sea have been shipped from the Port of Melbourne or Corio Bay in Geelong. There has been minor use of Gippsland ports at Hastings and Welshpool. Together with Barry Beach, Port Anthony, Port Albert and Lakes Entrance, the region's port infrastructure may offer potential to export wood from southern Gippsland either to domestic or international markets, or to receive imports from other Australian ports or the international market. An important potential focus area is whether use of Gippsland's ports provides a solution to importing more raw fibre to the region, by addressing road transport barriers from other regions which are posed by Melbourne and the Great Dividing Range. As noted above, this would require significant investment in port infrastructure and strategic consideration of supporting transport infrastructure, particularly road infrastructure in and around the ports and through the key transport corridors which connect South Gippsland with the Latrobe Valley. Extending the role of Gippsland's ports for the transport of forest and wood products would require considerable further analysis and testing to determine the full extent of the opportunities and assess the commercial viability of the approach.

***Rail***

Gippsland's rail transport needs are serviced by the Bairnsdale Line linking Melbourne and the regional cities of Warragul, Moe, Morwell, Traralgon, Sale and Bairnsdale. The Gippsland rail line is currently undergoing an upgrade involving infrastructure repair and replacement[16]. Works include a new Avon River bridge at Stratford (now completed), track duplication, signalling upgrades, a crossing loop extension, rail sidings and second platforms at several stations that will enable more frequent and reliable train services. The works are funded as part of an $83 million investment in regional rail maintenance under a Victorian government Building Works stimulus package[17].

With respect to freight transport for the forest and wood products sector, there is a high degree of scepticism among stakeholders about capacity of the rail network to support out-bound transport of finished and semi-processed goods beyond the current state. That is because, in general terms, the timber industry has limited experience with rail and the challenges of operating an efficient freight rail service for a small volume output is likely to make it financially unviable. Currently goods from OPAL Australian Paper's Maryvale site are distributed by rail from Maryvale to Victorian and interstate destinations and to export terminals in Melbourne for shipping to international markets. However, it is important to note that this involves considerable scale. At a smaller scale, Fenning Timbers at Bairnsdale has received funding from the Victorian Government to establish an intermodal facility in Bairnsdale to support rail freight for timber products[18].

[16] https://bigbuild.vic.gov.au/projects/gippsland-line-upgrade on 22/02/2022.

[17] https://www.premier.vic.gov.au/works-underway-support-key-freight-service on 22/02/2022.

[18] https://www.janegarrett.org.au/media-releases/future-in-freight-for-fenning-timbers/ on 22/02/2022.

## Other utility infrastructure

### *Energy*

Timber processing requires the presence and reliable availability of sufficient electricity to be viable. The presence of power generation and associated infrastructure in Gippsland has been a strategic advantage with respect to industrial development, including for the forest and wood products sectors.

### Coal-fired power

The Latrobe Valley has a long history of coal-fired power generation supplying electricity for most of Victoria's historic manufacturing development. However, existing coal-powered electricity infrastructure is reaching the end of its economic life. Increasing price pressure from renewables and anti-coal sentiment has meant that all coal fired power stations have commenced closures or announced closure dates. Hazelwood closed in 2017, Yallourn Power Station closure has been brought forward to mid-2028, and it is expected Loy Yang A and B will close before the official date of 2047[19]. Included in the Yallourn Power Station closure announcement, recognising a potential power supply deficit, EnergyAustralia committed to build a 350 MWe battery at the Yallourn site which is larger than any battery currently operating in the world[20]. The question remains, however, where will the electricity be generated?

### Power transmission

Regardless of the form of electricity generation, it is essential that transmission infrastructure is adequate for the task of powering industry. The poles and wire transmission infrastructure connecting to the power market will remain a strategic advantage, even as Gippsland (and Victoria) moves to alternative sources of energy. However, stakeholders consulted identified issues associated with maintenance and upkeep of transmission infrastructure and a concern that powerline operators are seeking to pass the cost of essential maintenance and upgrades to users.



[19] https://www.afr.com/policy/energy-and-climate/alinta-concedes-coal-plant-may-shut-15-years-early-20211012-p58z8x on 22/02/2022.

[20] https://www.energyaustralia.com.au/about-us/energy-generation/yallourn-power-station/energy-transition#:~:text=EnergyAustralia%20has%20reached%20an%20agreement,will%20be%20completed%20by%202026 on 22/02/2022.

## Clean and renewable energy

The Australian Energy Market Commission (AEMC) estimates that '*...the influx of battery storage and renewables will cut wholesale electricity prices by 39% or $207 in Victoria by 2024*'[21]. The Victorian government is providing targeted support for renewables. In 2020-21, a total of $543 million was allocated to six Victorian 'renewable energy zones', including the so-called 'windy east' in Gippsland[22]. Existing electricity transmission infrastructure and new AEMC shared access and investment rules '*...support additional generators joining the network, typically those using renewable energy, who will find the shared costs and greater flexibility appealing*'[23]. Supported by a $19.5m grant, the Star of the South project is to be located off Gippsland's south coast. As Australia's first offshore wind project, this will have potential to supply up to 20% of Victoria's electricity needs[24]. Other Gippsland based clean energy projects in the pipeline include windfarms (e.g. the Delburn Wind Farm to be constructed on land surrounded by HVP pine plantations[25]), and solar farms (e.g. at Hazelwood, McGauran Beach, Perry Bridge, Fulham, Toongabbie, and Maffra). Geothermal is an alternative energy option as demonstrated at the new Gippsland Regional Aquatic Centre which has a deep-bore geothermal heating system tapping into the aquifer below Traralgon[26]. Ground water at about 65ºC from a depth of more than 600 metres heats the swimming pool. Further, Gippsland is one of seven regions to receive Commonwealth funding for accelerated development and commercialisation of Australian hydrogen[27].

## Biofuels

Biomass and fibre residues from forests and wood processing are commonly used to fuel thermal energy plants. These biomass heatplant and steam systems may be extended to electricity cogeneration or thermochemical (i.e. gasification, liquefaction, and pyrolysis) or biochemical (i.e. anaerobic digestion, alcoholic fermentation and photobiological hydrogen production) biofuel conversion pathways (Lee *et al*, 2019, p.2). Biodiesel has also been demonstrated to have significant potential. Although these technologies are relevant, biofuel was not identified by stakeholders to be as significant as other opportunities.

### *Water*

Traditionally with plentiful rainfall and high-volume catchments, water infrastructure and water use by trees has not been a notable issue for stakeholders consulted. However, as it is an emerging topic of discussion in many communities it is important for the forest and wood products industry to adopt a positive engagement and share information around the role of forests in water supply and use. A positive example of forestry and water being complementary in the landscape is that many Gippsland water authorities are investing in trees and plantations as an integrated land use.

### *Telecommunications (including data) networks*

A common concern and of keen interest to multiple stakeholders are the current limitations and potential benefits of telecommunication infrastructure in Gippsland. Innovative technology is required to underpin current systems and to continually improve performance and reliability of internet and data transfer. Technology uptake is facilitated by reliable telecommunications and data networks with sufficient quality to deliver fluent communication and data transfer within and between supply chain actors. This enables participants to actively seek opportunities to achieve improvements within and between businesses. It

[21] Taken from https://www.aemc.gov.au/sites/default/files/2021-11/vic_fact_pack.pdf on 22/02/2022.

[22] Taken from https://www.energy.vic.gov.au/renewable-energy/renewable-energy-zones on 20/02/2022.

[23] https://www.aemc.gov.au/news-centre/media-releases/new-rule-win-win-transmission-infrastructure-investment on 22/02/2022.

[24] https://www.premier.vic.gov.au/big-boost-offshore-wind-drive-jobs on 20/02/2022.

[25] https://osmi.com.au/ on 20/02/2022.

[26] https://www.latrobe.vic.gov.au/Home/Major_Projects/Latrobe_Valley_Sports_and_Community_Initiative/Gippsland_Regional_Aquatic_Centre/Geothermal_Heating_Project on 20/02/2022.

[27] https://darrenchester.com.au/gippsland-shares-in-federal-hydrogen-hub-cash/ on 20/02/2022.

supports enterprises to anticipate emerging requirements to progress current business and can assist with preventing failure associated with ongoing use of redundant technology. Application of current and emerging technology through the supply chain, including Big Data, spatial information systems, and optimisers, enables fully informed strategic, tactical and operational decision making, and has become essential in managing forest resources more effectively (Allot *et al*, 2020, p.3). Further, Chouldhry and O'Kelly (2018, p.6) identified fifteen promising practices in the growing technological landscape of precision forestry. Almost all these rely on credible, accurate and timely data communication networks. The ideal objective is to have all infrastructure in place to support the full cycle of innovative development, from ideation to execution.

Telecommunications is an important focus for the forest and wood products sector driven by:

- Facilitating a safe operating environment.
- Enabling movement and transfer of large amounts of data between remote sites and enterprises in real time.

Technology offers the potential of fully integrated supply chains utilising multiple data sources to optimise plantation stewardship including design, establishment, management, wood flow modelling and product supply. Telecommunications infrastructure and remote connectivity is increasingly important, especially with rapid development of technology where data is exchanged, for example, via mobile devices for field audits, sales orders, machine navigation and performance optimisation. Although cyber security risk has been identified as a significant exposure "*...that will become increasingly real as farmers, fishers and foresters continue to adopt digitally enabled infrastructure, equipment and machinery*" (Borchi *et al*, 2021, p.4), several, but not all, supply chain operators are actively building security controls into their business systems.

Stakeholders identified many parts of Gippsland, particularly where forest industries operate, have limited or no communication and data connectivity. There has been some shift in state and federal government policies relating to regional communication. For example, the federal government $400 million national mobile network Black Spot funding programme, spread across the three main network providers, is well into the implementation phase[28]. As competing technologies push innovation, it is of interest to note that since August 2021 Starlink, a low Earth orbit (LEO) satellite, is a new alternative communication to the National Broadband Network. While radio communication infrastructure including critical emergency services networks has improved, gaps remain, with many recommendations from several bushfire royal commissions not yet implemented.

## Institutional infrastructure

### *Recruitment, Education and Training*

As in many other industries, stakeholders confirmed the forest and wood products sector has experienced labour and skills shortages for several years. Recent strategic campaigns to promote and attract people to the forest and wood products sectors have had limited success. Recruitment, training and retention of staff is reported to be increasingly difficult, particularly for regionally based businesses. The problem is not isolated to professional and specialist forestry skills. Stakeholders listed a wide range of shortage including unskilled labour, mill workers, IT specialists, analysts, truck drivers and experienced field operations people. On-ground forestry operational skills are being lost and not replaced. Many positions are filled with people who have very limited knowledge or practical understanding of specific job requirements. Of particular concern noted is the drain of experienced specialist firefighting personnel (and supporting equipment), which was noted by stakeholders.

[28] https://www.infrastructure.gov.au/media-technology-communications/phone/mobile-services-coverage/mobile-black-spot-program on 22/02/2022.

In addition to stimulating more interest and understanding of the industry potential to offer employment, there is considerably more opportunity for education and training in the wider community. This challenge has been a focus for industry in Gippsland for some time. On a national basis, a comprehensive schedule of Forest and Forest Products Industry (FFPI) operator qualifications has been developed collaboratively with all industry sectors creating units of competency for a full range of functions throughout the entire supply chain[29]. These units are nationally recognised within the Australian Qualifications Framework (AFQ) and approved Registered Training Organisations (RTO's) are now delivering training and assessment from Certificate II to Advanced Diploma level. Stakeholders confirmed the Forest Operator Licence (FOL) system is now utilised by many in the forest sector to maintain formal records of completed units of competency and qualifications achieved. Gippsland has considerable soft infrastructure capacity, education and training opportunities from certificate to degree level, with a history of forest and wood products education delivery in the region.

[29] https://www.aisc.net.au/committee/forest-management-and-harvesting-industry-reference-committee on 22/02/2022.

## Opportunities for infrastructure improvement

### Electricity

here exist opportunities for industry to play an increasing role in the new energy economy in Gippsland. For example, by utilising available land for complementary renewable generation infrastructure or through onsite power co-generation and contribution to the grid.

### Telecommunications

Reliable telecommunications coverage to address safety and data transfer requirements is critical. According to a recent Infrastructure Australia report (Infrastructure Australia, 2021, p.20), access to quality data is crucial for communities to meaningfully participate and arrive at fully informed decisions. They suggest that nationally standardised, transparent and consistent data is required across all sectors. A holistic systems view would see interconnection of data between natural hazards (such as bushfire, flood and coastal inundation), asset locations, population and impact data (Infrastructure Australia, 2021, p.20). Creation and maintenance of such data could assist the forest and wood products sector by enabling greater alignment with other Gippsland sectors and creating a holistic view of accurate and consistent information. There are opportunities to:

1. Improve knowledge about gaps in coverage and identify critical opportunities to enhance telecommunications capacity.
2. Clearly identify and quantify benefits from improved telecommunications coverage and capacity in regard to:
    - Safety
    - Big data and rapid data sharing from point of harvest to dispatch
    - New technology such as 5G mobiles and low Earth orbit satellites

### Roads

The importance of road infrastructure to the forest and wood products industry has been studied by various authors at a national and regional level and includes developed of a Transport Network Strategic Investment Tool (TraNSIT) by CSIRO that provides useful insights into transport logistics costs and benefits in Australian agriculture supply chains. This model was applied in a 2017 study (Higgins *et al*, 2017, p.11) to determine the baseline road transport activity for Australia's forestry plantations based on individual path segments of the supply chain, such as between a specific plantation and a sawmill, the current conditions of the road network and current estimates of the timber supply forecast until the year 2041[30]. Figure 11 demonstrates the extent and volume of plantation forestry road transport in Gippsland and notably that the highway link to Melbourne has one of the greatest transport densities in Australia.

[30] https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/forestry/transit-supply-chain-report.pdf

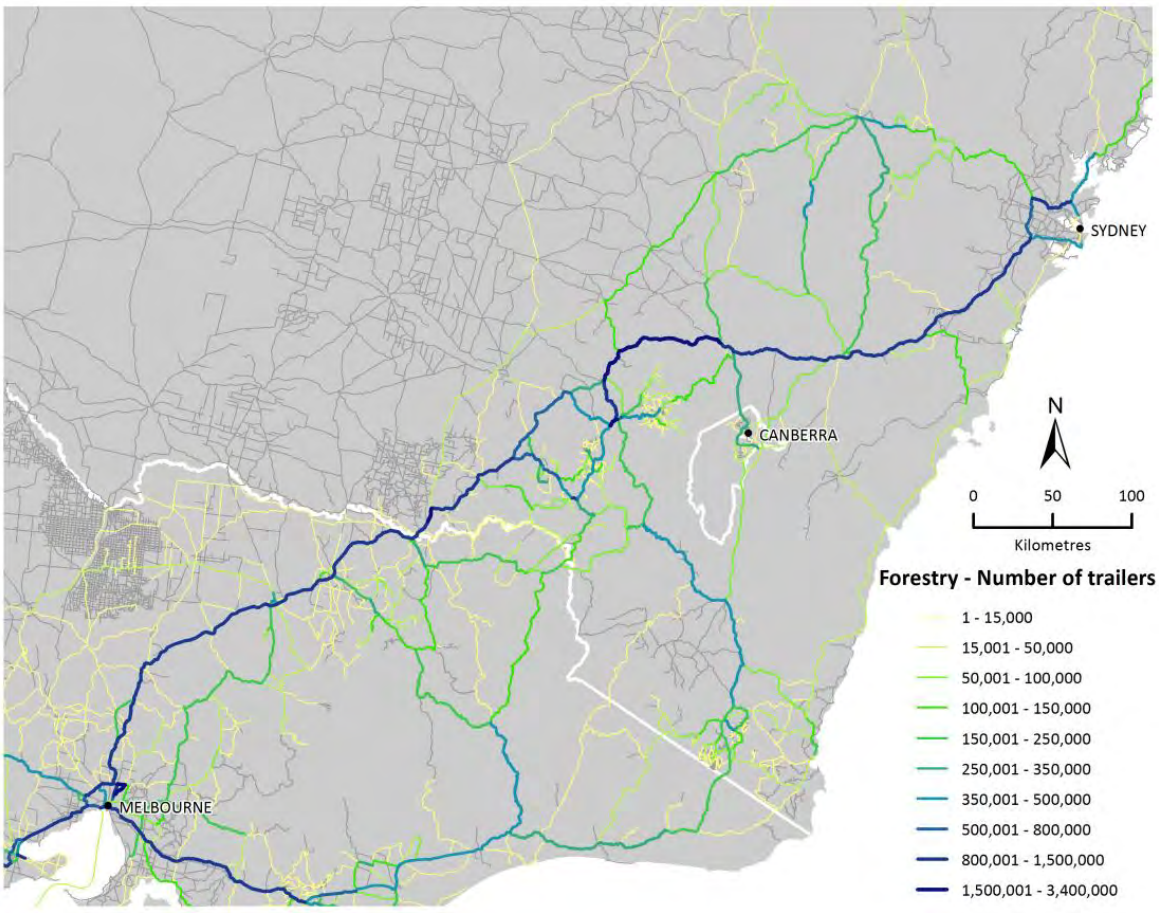



*Figure 11: Baseline transport density (number of semi-trailers equivalents on roads) for plantation timber over 25 years (2016-2041) in south-eastern Australia (taken from Higgins et al, 2017, p.13, Figure 6).*

A general perception among stakeholders consulted is that the current road transport infrastructure is reasonably effective, and that future volumes will be less than current. However, there are specific opportunities, including:

- Localised issues (e.g. design of specific intersections), issues relating to multi-user local roads (e.g. safety and flow), poor maintenance (contributing to higher transport costs by reducing average travel speeds and increasing R&M costs) and local government approvals and regulation.
- General congestion with roads under increasing pressure, particularly the Hyland Highway and other links between the coast and the Latrobe Valley, due to increased usage from expanding local populations, tourism, renewable energy development and existing other uses.

Specific challenges and issues identified include:

- Roads that require sealing (e.g. access roads to processing plants in Yarram and Alberton).
- Opportunities for increased carriageway capacity (e.g. Hyland Highway and Grand Ridge Road)
- Priority intersections to upgrade for safety and flow.
- Roads where current and future use could conflict with other uses; what is likely to happen?

### Rail

In broad terms stakeholders considered that rail is not a significant solution for industry in Gippsland beyond current use, generally as rail freight distances are relatively short and potential volume of products is low. Combined with the problem of double-handling and potential commercial contractual challenges, rails is an unlikely freight solution. However, truck access to Melbourne Port and increasing congestion throughout the metropolitan area is a growing concern for interregional road freight operators. In order to reduce truck traffic on city roads and throughout the Melbourne Port precinct, the State Government is supporting urban rail developments; for example the Dandenong South Port Rail Shuttle Intermodal Terminal currently under construction is designed to replace road transport with dedicated rail freight services[31]. Should this model prove successful, there may be potential to revisit rail freight and integrate with regional rail nodes such as Bairnsdale.

### Ports

Gippsland's port infrastructure is currently underutilised and not well linked with other infrastructure or industry. There is potential to better utilise Gippsland ports for inbound and outbound forest and wood product freight. A more informed understanding would involve detailed consideration of requirements for networked infrastructure, specifically roads. There is a considerable body of work which is required to determine whether or not this opportunity will stack up logistically and commercially.

### Education and training, research and development

Gippsland has had a focus on education and training, as well as research and development (e.g. a CSIRO research station in the 1980s) in relation to the sector. It has existing infrastructure (hard and soft) which can be capitalised on with a focus to improve the region's capacity for forest and wood products innovation.

### Local business and community engagement networks

There is a significant opportunity to expand the role of formal business and community engagement networks (soft infrastructure) to improve collaboration and identify and realise commercial opportunities to deliver innovative win-win solutions to known and emerging challenges.

## Infrastructure gap analysis

### Gap analysis context

Modelling presented earlier in this report identified a realistic scenario where the total available wood fibre grown in Gippsland will decline by about one-third (2.3 million $m^3$/y to about 1.5 million $m^3$/y) between now and 2030 and will remain at about that level in the long-term. Already replacement fibre is being imported from other regions and there may be opportunities to increase inflow of fibre from outside Gippsland. In this context, an infrastructure gap analysis is focussed on:

- Opportunities to improve efficiency of current infrastructure focussed on wood fibre from within Gippsland.
- Opportunities to focus infrastructure enhancements to cater for imported fibre.

[31] https://transport.vic.gov.au/ports-and-freight/key-freight-projects#PRS on 22/02/2022.

## Priority infrastructure gaps

A summary of the key findings is presented in Table 8.

*Table 8: Summary of gap analysis findings and priority infrastructure issues for Gippsland's forest and wood products sectors*

| Element | Issue | Gap | Typology |
|---|---|---|---|
| **Policy & regulation** | Bureaucratic processes add cost and demotivate investment. | LGA planning approvals are slow, complex and inconsistent and seem biased against development of forest and wood products industry. This extends to State government and the native forest harvesting transition. | Soft Institutional |
| | Fire, flood and storm damage to forests and infrastructure; roads, rail, ports, electricity, telecommunications and data. | Significant ongoing risk is known but mitigation is slow or not properly understood. | Hard Utilities<br>Soft institutional |
| **Electricity** | Increasing coal based energy costs, community and environmental impacts. | A lack of a confident plan for transition to renewable energy. | Hard Utilities |
| **Gippsland as an innovation centre** | Research and Development to better understand potential of tree breeding for multiple sites and end uses, water issues, chemicals, and natural environmental risks, technology and innovative solutions | Some inadequately understood issues are likely to have significant long-term positive or negative potential, and require a whole of industry approach to strategy, management and funding. | Soft Institutional |
| | Difficulty to recruit and retain an acceptable workforce and specialist skills. | Perceived as not an attractive industry and a limited number of people with valued skills and experience to undertake the work and to mentor others. | Soft Institutional |
| | Innovation is a cornerstone of developing creative solutions to significant barriers and opportunities. | A lack of all infrastructure required to be able to process the full cycle of innovative development from ideation to execution. | Hard Utilities<br>Soft Institutional |
| | Limited extension of services, slow problem solving and improvement progress throughout the supply chain. | A lack of motivation and confidence to innovate and invest due to limited future income security. | Soft Institutional |
| **Trees on farms** | Integration of primary production systems on a commercially rational basis. | Lack of support for integrating forestry into commercial farming systems. | Soft |

| Element | Issue | Gap | Typology |
|---|---|---|---|
| **Telecommunications & data** | Unable to fully utilise productivity improvement technology. | Unreliable internet, communication connectivity and slow data transfer. | Hard Utilities |
| | Opportunity to exploit current and emerging supply chain technology through Big Data, AI, spatial information systems and optimisers, enabling fully informed strategic, tactical and operational decision making. | Slow uptake of information systems technology due to limited understanding, financial security and perceived risk. | Hard Utilities |
| | Perceived cyber security issues with information systems and new technology. | Lack of confidence or investment in cyber security risk management. | Hard Utilities |
| | Unable to fully optimise all decisions due to being data rich but intelligent information poor. | Limited analysis, interpretation and decision support resources. | Hard Utilities |
| **Supply chain collaboration** | Small-scale operators struggle to be viable. | Small-scale operators are disconnected and not recognised by the market as being important to industry.<br>Lack of viable business models and specialist advisory services. | Soft Community |
| | Opportunity for whole of supply chain integrated optimisation involving decision support information, resource expansion, technology uptake and strategic planning. | Different participants along the supply chain are unwilling or unable to recognise the opportunity to integrate for a greater net benefit. | Soft Community |
| | All infrastructure required or to be considered needs to be understood prior to plantation establishment to integrate and optimise the whole wood supply catchment over time. | Silo thinking in design and management of separate operations can be driven by seeking least cost for segments in isolation. | Soft Community |
| | Circular economy opportunities to tap into existing government and community sentiment towards recycling and reuse. | Silo thinking and limited interaction within the forest and wood products sector and between this sector and other sectors active in the region. | Hard Utilities |

| Element | Issue | Gap | Typology |
|---|---|---|---|
| **Harvesting & haulage systems** | Transport of goods is slow on the Hyland Highway and through Melbourne | Road congestion due to volume of traffic and size of roads. | Hard Utilities |
| | Alternative transport options to import of fibre and export manufactured goods are not proven | Rail may offer attractive alternative to road transport.<br>Gippsland Ports may offer attractive alternative to Melbourne and Geelong ports. Potential is unknown. | Hard Utilities |
| | Potential bottleneck at weighbridges | Not known if more weighbridges or better weighbridge systems are justifiable.<br>Use of alternative technology such as load cells on trucks and/or paperless and wireless data transfer. | Hard Utilities |
| | Local road limits and conditions | Landscape level strategic plan to understand which roads need improvement and funding to support. | Hard Utilities<br>Soft Institutional |
| | Difficult or not possible for large modern trucks to access some local roads due to alignment and grade, design of intersections and bridge load capacity. | Local roads not originally designed for large modern equipment. Lack of funding and commitment to upgrade strategic roads, or in some locations to better match truck configuration to road conditions. | Hard Utilities<br>Soft Institutional |
| **Social license** | Neighbours and community create blockages or slow improvement development. | Limited social license to operate. Lack of understanding and effective collaborative networks with government, business and community groups. | Soft Community |
| **Resource availability** | Wood fibre supply shortage and opportunity for long distance inter-regional and interstate wood flow. | Truck configurations and approvals to enable cost-effective long-distance haulage including potential back-loading a range of products. | Hard Utilities |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# Synthesis

Synthesis of the findings of this project recognises that future success and viability of the industry in Gippsland relies on an ability of the sector to innovate, adapt and transition to new ways of doing business, across the whole supply chain. Essential to the ability to innovate is availability of adequate infrastructure to underpin efforts of industry as a whole, and individual enterprises, to make this transition. To put it simply, industry must innovate and to do that it needs the right supporting infrastructure tools.

## The challenge

### Secure and reliable access to fibre

Fibre is essential for innovation. The overriding challenge facing the forest and wood products sectors in Gippsland is at least maintaining if not increasing secure and reliable access to fibre. It is clear that opportunities to increase fibre production from within the region are limited at best, and regardless, have such long lead times as to be meaningless in the context of this report. Therefore, any additional fibre must be imported from outside the region as logs, semi-processed timber or wood fibre, which processors can utilise to manufacture wood products. Importantly, secure and reliable access to fibre is a fundamental precursor to enterprise level investment, whether for new equipment and upgrades, new technology and skills, new manufacturing processes or in product development.

### Digital communication

The role of telecommunications and digital data in the forest and wood products supply chain is of escalating importance. Reliable telecommunications infrastructure and capacity is a recognised challenge in Gippsland. Innovation depends on efficiencies and improved supply chain functions are possible with improved flow of digital information. This requires reliable and broad telecommunications coverage.

### Electricity

Wood products manufacturing is a significant consumer of electricity. Reliable and affordable electricity supply is essential to efforts targeted to grow the sector in Gippsland.

### Transport infrastructure

The vast majority of logs and manufactured wood products are transported by road. However, rail (for outbound paper and packaging) and sea (for outbound woodchips and inbound logs and semi-processed timber) freight are important aspects of the transport matrix for Gippsland's industry. It seems unlikely that use of rail freight can be expanded in Gippsland. However, potential opportunities with Gippsland's port infrastructure warrant further consideration, particularly in the context of importing fibre from other regions and potentially from other countries, particularly New Zealand.

### Knowledge and people

People innovate and therefore successful innovation requires knowledge and skilled people. Gippsland has had a long-term focus on education, skills and training and is home to research and development capacity. An ability to leverage this soft infrastructure capability to underpin the sector's development presents challenges and opportunities.

## Identification of priorities

### Consolidated opportunities

A range of innovation barriers and infrastructure gaps have been identified. Table 9 presents a consolidated list of innovation and infrastructure opportunities to address these barriers and gaps. Where complementary opportunities exist, there is a greater likelihood of progressing actionable solutions to identified elements. Twelve opportunities have been identified for further consideration and priority setting. These opportunities are presented in Table 9.

*Table 9: Consolidated innovation and infrastructure opportunities*

| | Element | Innovation | Infrastructure |
|---|---|---|---|
| 1 | **Policy and regulation** | Whole of region approach to interfacing with local government on regulatory and planning barriers. | Whole of industry collaboration to improve local government response to road transport infrastructure challenges. |
| 2 | **Gippsland as an innovation centre** | Potential for Gippsland to host an industry innovation centre, exploiting existing regional advantages. Focus on new product and business systems innovations. | Capitalising on Gippsland's existing education, training and research infrastructure. Focus on attracting the right skill sets and retaining them in the region. |
| 3 | **Trees on farms** | Realistic evaluation and assessment of forestry integrated into agricultural systems, considering what has worked in other jurisdictions. | Examine soft infrastructure barriers to investment in integrated forestry/farming systems. Particular focus on partnerships, networks and extension services. |
| 4 | **Telecommunications and data** | Telecommunications and data innovations to deliver improved safety, logistics and decision-making outcomes. | Develop a detailed understanding of key telecommunications infrastructure 'weak points' and how these can be addressed to deliver improved telecommunications outcomes and uptake of digital technology. |
| 5 | **Supply chain collaboration A** | Create a timber industry circular economy and links with other sectors to maximise value at each point along the supply chain. | Capitalise on Victorian Government's focus on recycling and reuse as an infrastructure priority for Gippsland and the industry's role in the circular economy. |
| 6 | **Supply chain collaboration B** | Process and systems innovations that rely on collective effort and collaboration to ensure success. | Building industry networks. Identifying opportunities for improved operational or product integration to drive net benefits. |

| | Element | Innovation | Infrastructure |
|---|---|---|---|
| 7 | **Harvesting & haulage systems** | Innovation in haulage to consider new systems (e.g. truck configurations), improving viability of back-haulage and minimising number of haulage trips. | Examine in detail infrastructure barriers to implementation of more innovative and efficient haulage systems (e.g. congestion, alignments, weighbridges, road widths, weight limits). |
| 8 | **Social license** | Identifying innovative solutions to address social license issues; e.g. chemical use, traffic near built up areas, environment etc. | Work with soft community infrastructure to identify and address social license issues which are preventing innovation and industry efficiency. |
| 9 | **Resource availability A** | Specialist plantation expansion aligned with existing plantations; don't rely on the 'industrial expansion'. | Collaboration networks within and external to the industry. |
| 10 | **Resource availability B** | Identify alternative fibre resources to underpin maintenance and expansion of industry in Gippsland. | Relies on ability to utilise or improve existing infrastructure to allow longer road transport distances and potentially sea freight. |
| 11 | **Maximising fibre** | Further explore the role of the circular economy and fibre distribution, including: alternative processing technology adapted to changing log attributes; movement of semi- and fully processed wood products between processors; examination of renewable energy production from wood residues. | Development of an industry manufacturing hub concept with networked multi-use infrastructure. |
| 12 | **Market access** | Exploration of emerging distribution channels; e.g. on-line direct-to-customer systems and regional on-line trading platforms to enable more efficient logistics. | Consolidated benefits from improved digital and transport infrastructure to deliver new methods of market access. |

## Priority setting framework

The 12 consolidated opportunities represent a significant potential body of work for the Hub. In order to ensure the Hub's efforts and resources are focused in appropriate areas, a priority setting framework has been applied using the matrix presented in Table 10.

*Table 10: A matrix approach for identifying and setting Hub priorities*

| | Low effort | High effort |
|---|---|---|
| **High impact** | **Priority 1**<br>Low hanging fruit – short-term gains for little effort which can deliver early benefit | **Priority 2**<br>Medium to long-term and potentially complex projects with significant potential gains |
| **Low impact** | **Priority 2**<br>Short to medium-term projects with minimal input required generating a low impact | **Priority 3**<br>Complex or contentious projects with either no prospect of early returns or dubious long term returns |

## Identified priorities

This assessment has identified five high priority and five medium priority focus areas to address innovation barriers and infrastructure gaps for the Hub, as summarised in Table 11. These ten priorities form the basis of recommended actions.

*Table 11: Identified priorities for action by the Hub*

| | Element | Effort | Impact | Priority | Rationale |
|---|---|---|---|---|---|
| 1 | **Policy and regulation** | High | High | 2 | Engagement with regulators and policymakers is challenging, as has been demonstrated with public native forest policy, local government regulation and, as an example, the Code of Practice review. However, if coordinated and achieved, it presents a significant area of potential momentum. |
| 2 | **Gippsland as an innovation centre** | High | High | 2 | The first hurdle is the lack of recognition of forestry in existing institutional responses to innovation in the region. Other challenges include industry alignment, identifying a point of difference that justifies Gippsland's focus (as distinct from other regional focal points) and generating a delivery model which can be sustained into the future. |
| 3 | **Trees on farms** | Low | High | 1 | This represents a significant area of policy focus for both the Victorian and Australian Governments and aligns with existing work which the Hub has commissioned. |
| 4 | **Telecommunications and data** | Low | High | 1 | Initial work in relation to this element can be achieved with relative ease – focused on a more detailed gap analysis specific to the telecommunications task. |

| | Element | Effort | Impact | Priority | Rationale |
|---|---|---|---|---|---|
| 5 | **Supply chain collaboration A** | High | High | 2 | While opportunities to use the circular economy in a more sophisticated way for forestry in the region present exciting potential development, there is a strong reliance on other sectors and current Victorian Government policy focus does not include the forest and wood products sector. |
| 6 | **Supply chain collaboration B** | Low | High | 1 | The Hub is strongly situated to focus on improving forest and wood products sector business networks and to link with other sectors and government agencies. This requires practically no cost and can rely on existing momentum to get underway. |
| 7 | **Harvesting & haulage systems** | High | High | 2 | Individual enterprises are already looking to more efficient transport systems, particularly truck configurations, to deliver safer, more economical forest products freight outcomes. However, potential constraints (for example, to larger truck configurations) are only able to be solved with the right regulatory and policy settings, which sit with local authorities and State Government agencies. |
| 8 | **Social license** | High | High | 2 | The broad social license issues are well documented and understood. The development of solutions is not so easy. Any transition or change is likely to exacerbate potential social license issues. This is an important area to address but precedent demonstrates that it is challenging. |
| 9 | **Resource availability A** | High | Low | 3 | There are significant constraints to plantation expansion. Current work is being progressed by the Victorian Government. However it slow and is unlikely to deliver meaningful outcomes for at least 15 years. |
| 10 | **Resource availability B** | High | High | 1 | Identifying alternative raw fibre sources, both within and outside of Gippsland, is an important priority if the industry is to situate itself for growth in the region. |
| 11 | **Maximising fibre** | High | High | 1 | Innovation and infrastructure solutions which improve the optimisation of fibre delivery (i.e. in terms of cost of delivery and highest value end-use) and maximise its use (i.e. minimise waste) must be a focus to improve on the current situation. |
| 12 | **Market access** | High | Low | 3 | In the current environment, with reducing availability of fibre, this is not a priority focus. |

## Recommendation actions

Six specific actions are recommended to address the category 1 and 2 priorities identified in Table 11.

**Recommendation 1: Industry collaboration (Elements 1, 5, 6 and 8)**

The Hub to engage with Gippsland's forest and wood products sector to develop and formalise an industry collaborative business network with defined objectives to mandate and address:

5. Whole of industry engagement with local government decision-makers to improve planning and regulatory decision-making.
6. Actions to exploit emerging opportunities presented by the circular economy.
7. Opportunities to deliver whole of sector win-win process and systems innovations.
8. Specific social license issues which prevent development of the sector in Gippsland.

**Recommendation 2: Gippsland as an innovation centre (Elements 2 and 7)**

The Hub to commission a detailed study to further develop a plan for the Gippsland industry to establish a forest and wood products innovation centre of national significance. The study is to consider similar examples in Australia and internationally. An important focus is how a Gippsland innovation centre would set itself apart from similar centres in other regions. Examples may include: advanced manufacturing; training and education; transport and logistics; data management and telecommunications.

**Recommendation 3: Embracing the digital economy (Element 4)**

The Hub to undertake a detailed study to identify telecommunications and digital economy opportunities and barriers. The study would also assess industry readiness and capacity to participate and develop an industry digital evolution strategy for Gippsland.

**Recommendation 4: Integrating trees with agricultural systems (Element 3)**

The Hub to commission a comprehensive evaluation and assessment of opportunities to foster integration of commercial forestry into traditional agricultural production systems. This project would leverage existing work focused on plantation capability and examine examples from Australia and internationally (e.g. New Zealand and Scandinavia) to develop an actionable strategy for Gippsland.

**Recommendation 5: Alternative fibre resources (Element 10)**

The Hub to commission a project to explore realistic opportunities to increase fibre availability from outside Gippsland. This will identify where potential fibre resources are located which could practically be imported to Gippsland and what commercial and infrastructure developments are required to achieve the increase.

**Recommendation 6: Industry manufacturing hub (Element 11)**

The Hub to commission a study to explore the opportunity to develop an industry manufacturing hub. The study is to explore opportunities to work efficiently with other sectors, exploit the circular economy, focus on product recycling and re-use, exploit systems to maximise fibre use and minimise supply chain costs, and link with the proposed Gippsland industry innovation centre.

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# Appendices

## Appendix 1: Plantation productivity in Gippsland

### Yield tables used to determine future wood supply estimates

Table 1 presents the ABARES yield tables (Legg *et al*, 2021) for various plantation management regimes for the Central Gippsland and East Gippsland-Bombala National Plantation Inventory regions.

***Table 1: Yield tables for Eucalypt and P. radiata plantations under various silvicultural regimes in Gippsland***

| | | Clearfall | | | Second Thinning | | | First Thinning | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Region** | Regime | Age | S/log $m^3$ | P/log $m^3$ | Age | S/log $m^3$ | P/log $m^3$ | Age | S/log $m^3$ | P/log $m^3$ | MAI $m^3$/ ha/y |
| **Central Gippsland** | Eucalypt sawlog | 40 | 200 | 450 | | | | 20 | 0 | 150 | 20 |
| | Eucalypt pulplog | 12 | | 216 | | | | | | | 18 |
| | P. radiata sawlog | 30 | 240 | 170 | 20 | | 110 | 15 | | 80 | 20 |
| **East Gippsland - Bombala** | Eucalypt sawlog | 27 | 112 | 128 | 16 | | 80 | 10 | | 64 | 14 |
| | Eucalypt pulplog | 12 | 228 | | | | | | | | 19 |
| | P. radiata sawlog | 30 | 220 | 30 | 24 | 70 | 40 | 16 | | 110 | 16 |

### Softwood plantation productivity in Gippsland

***A general observation on plantation productivity***

At a micro or individual land-unit scale, sustainability can be measured by the ability to maintain site productivity over subsequent crops and for subsequent generations. Impact of plantation management practices on productivity of subsequent crops has been researched for short rotation plantations and Yamada *et al*. (2004, p.1)[32] provides the following comments; *"There is concern about the potential decrease in productivity caused by nutrient*

[32] Yamada *et al*. (2004) reports on an analysis of growth rates and nutrient accumulation across 40 industrial plantations at 21 sites in 11 countries.

*loss by intensive and repeated harvesting. It is important to determine the nutrients removed and conserve them as much as possible to prevent productivity loss and for sustainable management of industrial plantations. Careful management of the nutrient cycle through residue retention and fertiliser application is necessary to maintain high productivity."* Keeves (1965, p.51) reported that: *"Fears of a loss in production with successive rotations of coniferous forests have disturbed the thoughts of many foresters since the classical example of deterioration of spruce stands in Saxony was first recorded by Wiedemann in 1923."* Keeves (1965, p.51) continues to provide evidence of a second rotation decline for P. radiata growing in South Australia. Subsequent research resulted in management practices changing (genetics and site specific management) and an analysis of operational results indicated a 60 to 70% increase in productivity (O'Hehir & Nambiar, 2010, p.1,857). Such practices were adopted across many industrial plantation estates.

Gippsland has a long history of softwood plantation establishment, management and harvesting with some sites on their third rotation. In order to maintain productivity, the importance of adoption of judicious and site specific silviculture is well recognised (O'Hehir & Nambiar, 2010, p.1857) including conserving site resources during the inter-rotation phase, organic matter, nutrients and moisture conservation (control of weeds) (Wu *et al*., 2007); O'Hehir and Nambiar, 2010: p.1,857). Analysis in Gippsland (Hescock *et al*. 1999, p.176) indicated a 63% increase in productivity for P. radiata between rotations attributed to genetics and silviculture. A key point is whether biological limits at reasonable cost have been met in regard to productivity improvement.

## Modelled plantation productivity for Gippsland

Productivity for *P. radiata* plantations in Gippsland has been analysed and reported. Burns *et al*, (1999, p.151, Table 1) indicated productivity range of 12 to 20 $m^3$/ha/y for sites with rainfall of <700 to >900 mm/y. Borschmann *et al* (2000, p.12, see Table 2) presented a more detailed analysis based on underlying geology as a proxy for soils. The authors set a lower limit of rainfall at 550 mm/y based on existing commercial plantations in Gippsland in the 550–600 mm/y range (Borschmann *et al*., 2000, p.8). An important point is that yield presented is not segmented between first and subsequent rotations. Borschmann *et al*., (2000, p.8) indicated source data and based on industry knowledge, sites could have included first rotation on ex-pasture (e.g. Willmot Forest Management Ltd) and subsequent rotation sites (e.g. Hancock Victorian Plantations Pty Ltd and Australian Paper Plantations). While site fertility of ex-pasture site established to P. radiata may provide improved growth, a point of caution is adverse impacts on stem form. Toorour syndrome is where P. radiata trees have deformed stems and poor form on sites in south-eastern Australia. The syndrome appears to be under genetic control and stimulated by high nitrification in the soil (Turvey *et al*, 1993, p.189).

***Table 2: A detailed yield for site for P. radiata in Gippsland (Borschmann et al., 2000, p.12, Table 3). Highlighted cells are based on data and the balance are extrapolated***

| | | Rainfall (mm/y) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **550-599** | **600-699** | **700-799** | **800-899** | **900-1000** | **>1000** |
| **Quaternary sediments** | Qrm, Qrd, Qpc, Qrp | U/S | U/S | U/S | U/S | U/S | U/S |
| | Qra, Qrc, Qrt, Qr1, Qp2, Qp3, Qp4, Qp5 | 11-15 | 11-15 | 16-20 | 16-20 | 21-25 | 21-25 |
| | Qpd, Qp1 | 11-15 | 16-20 | 21-25 | 21-25 | 21-25 | 21-25 |
| | Qpa, Qpb | 16-20 | 21-25 | 21-25 | 21-25 | 21-25 | 21-25 |

| | | Rainfall (mm/y) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 550-599 | 600-699 | 700-799 | 800-899 | 900-1000 | >1000 |
| **Tertiary sediments** | Tml | U/S | U/S | U/S | U/S | U/S | U/S |
| | Tph | 16-20 | 21-25 | 21-25 | 21-25 | 21-25 | 21-25 |
| | Tmp, Tpb, Tp, Tpx | 11-16 | 16-20 | 21-25 | 21-25 | 21-25 | 21-25 |
| **Metamorphics** | O-Sn, O-Ss, O-Sq, SDs | N/A | 11-15 | 16-20 | 16-20 | 16-20 | 16-20 |
| **Granite-like** | O-Dg, Dmy, Dgl, Dls, Sg, Dlg, SDg, Dug, Dvd | N/A | 16-20 | 16-20 | 21-25 | 21-25 | 21-25 |
| **Cretaceous sediments** | Kls, Klb, Tec | N/A | 21-25 | 26-30 | 31-34 | 31-34 | 31-34 |
| **Tertiary extrusive** | Tvo | N/A | 16-20 | 21-25 | 21-25 | 21-25 | 26-30 |
| **Silurian-Devonian sediments** | Duc, Dlt, S, Dls, SDl, SDj, Dlh | N/A | 16-20 | 16-20 | 21-25 | 21-25 | 21-25 |
| **Ordovician sediments** | Ou, Oal, Op | N/A | 16-20 | 21-25 | 21-25 | 26-30 | 26-30 |
| | O-sg, Sg-Dl, Oh, OSks | N/A | 11-15 | 11-15 | 16-20 | 16-20 | 16-20 |

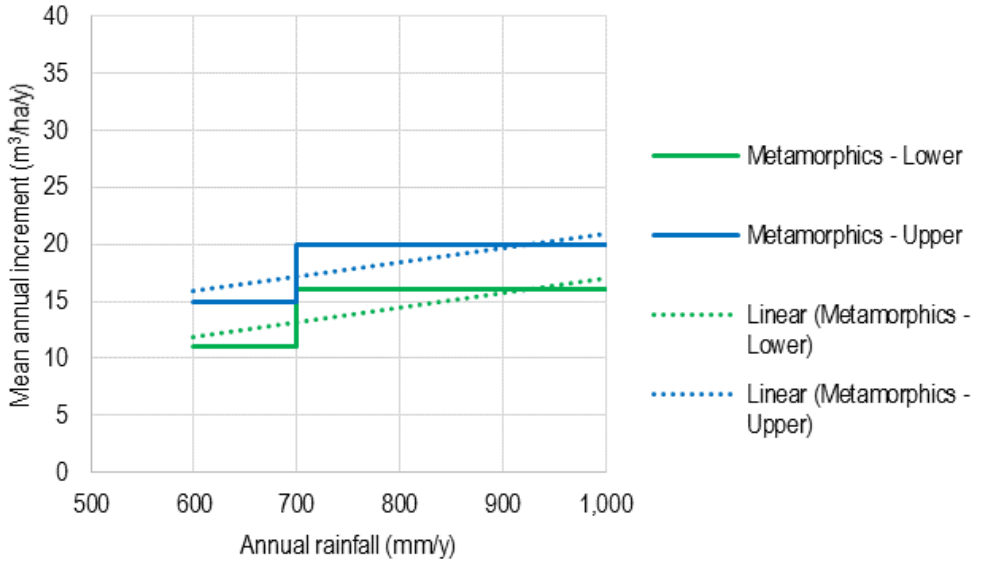



*Figure 1: Productivity bands for rainfall in Gippsland for metamorphic based soil types (based on Borschmann et al, 2000, p.12, Table 3).*

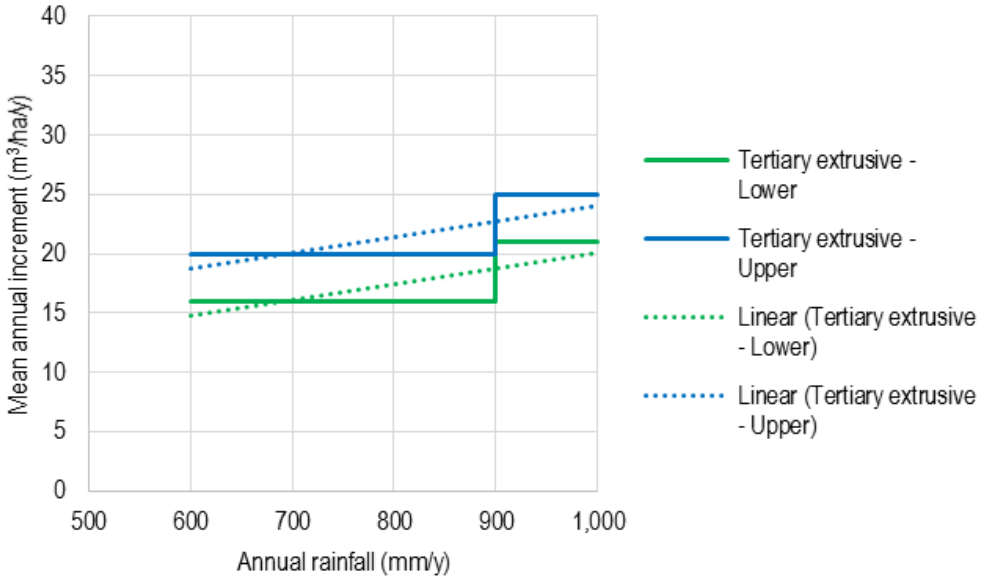



*Figure 2: Productivity bands for rainfall in Gippsland for tertiary extrusive based soil types (based on Borschmann et al, 2000, p.12, Table 3).*

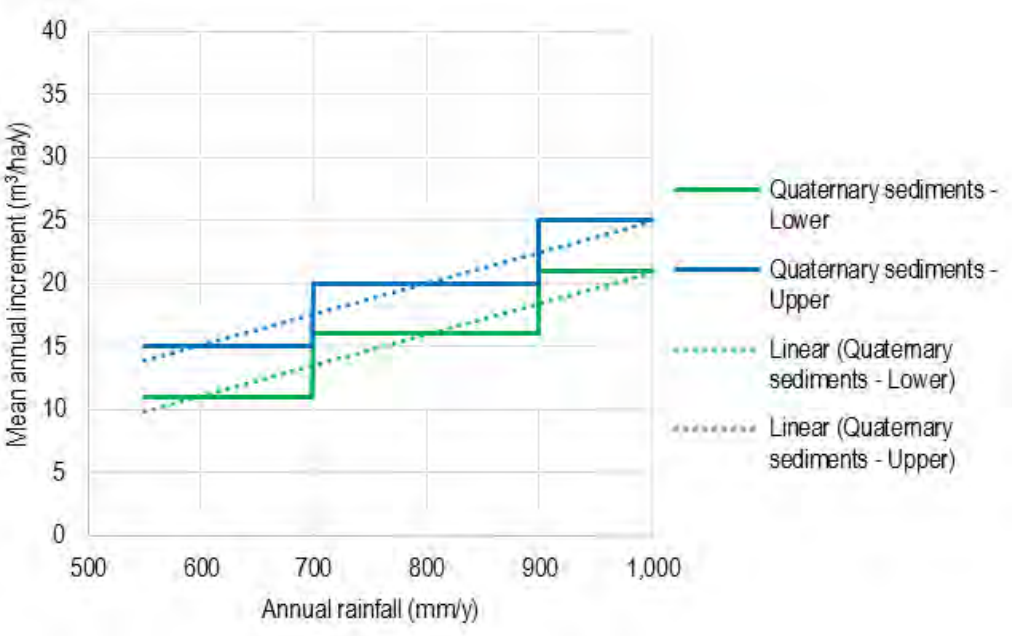



*Figure 3: Productivity bands for rainfall in Gippsland for quaternary sediments based soil types (based on Borschmann et al, 2000, p.12, Table 3).*

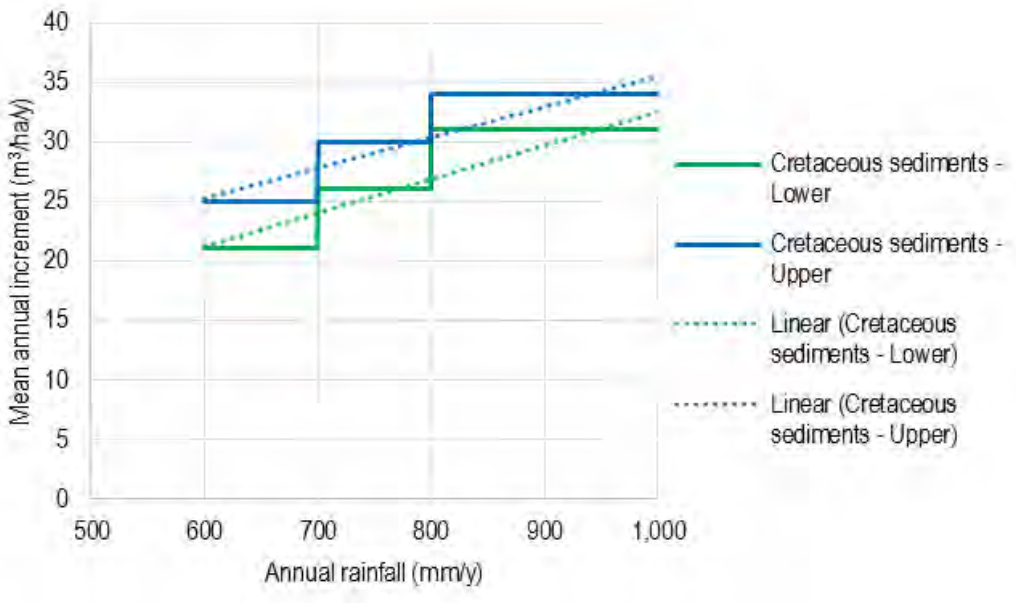



*Figure 4: Productivity bands for rainfall in Gippsland for cretaceous sediments based soil types (based on Borschmann et al, 2000, p.12, Table 3).*

## Hardwood plantation productivity in Gippsland

This section outlines the results of a number of trials which have been undertaken in Gippsland to provide a more refined outlook of potential Eucalyptus plantation productivity across the region.

### *Late 1980s eucalypt species trials*

A series of trials with 12 species and provenance were established by APM Forests and government forest agencies in the late 1980s. The sites were later measured and growth performance assessed and reported (Duncan *et al*, 2000). The authors described the characteristics of the sites:

*"Trial sites were previously Pinus radiata plantations, improved pasture or native forest. The sites range in altitude from 40 to 400 m, have an annual rainfall between 600 and 1220 mm, and average daily maximum and minimum temperatures range from 22-26 and 10-13°C in January, and 9-14 and 2-5°C in July. Soils vary in profile from uniform deep sands and texture contrast soils to gradational textured soils."*

(Duncan *et al*, 2000: p. vii)

The authors also cautioned limitations about use of the information.

*"The study did not include sites which were representative of the higher altitude regions of the Strzelecki or Great Dividing Ranges, or the lower rainfall zone between Traralgon and Bairnsdale (commonly referred to as the 'Red Gum Plains'). Extrapolation of the results to either of these regions is not recommended."*

(Duncan *et al*, 2000: p.i).

Rainfall data for the sites was based on the ESOCLIM model (Hutchinson, 1991 cited by Duncan *et al*, 2000: p. vii).) based on long-term averages rather than actual rainfall for the period.

The trials were located as follows.

- **1986 trials:** Mt Worth West, Narracan East, Yinnar, Maryvale and Gormandale sites. At age 12 years, all trees were measured for DBHOB and height.
- **1987 trials:** Mt Worth East, Delburn, Flynns Creek, Stradbroke and Stockdale sites. At age 11 years, all trees were measured for DBHOB and height.
- **The Tostaree trials:** The trials were established in August 1988, measured for DBHOB and height at age 11 years.
- **The Waygara trials:** The trials were established in August 1989, measured for DBHOB and height at age 10 years.

The authors made the following observations based on their assessment of the trials:

*"Mean annual increment (MAI) of the most productive seedlot at each site varied from 13 $m^3$/ha at Yinnar to 57 $m^3$/ha at Mt Worth West. Stem volume varied greatly within each site, with a 15 to 60-fold difference between the best and worst seedlots.* ***E. globulus****,* ***E. nitens*** *and* ***E. viminalis*** *were generally the most productive species at each site, while* ***E. camaldulensis****,* ***E. tereticornis****,* ***E. melliodora*** *and* ***E. sideroxylon*** *had generally poor productivity.*

*Species x site interactions were present at most sites. Growth trends were generally similar within the Viminales (****E. globulus****,* ***E. viminalis*** *and* ***E. nitens****) and within the Salignae (****E. saligna****,* ***E. botryoides*** *and* ***E. grandis****). On the highest productivity sites (1000+ mm rainfall and gradational textured soils) the growth of* ***E. nitens*** *was outstanding. On the lowest productivity site (600-699 mm rainfall and uniform deep sands)* ***E. botryoides*** *was the most productive species. On all other sites,* ***E. globulus*** *was the most productive species.*

*The key points are:*

- ***Species:*** *The trial was exclusively eucalypt species with a focus on pulp production.*
- ***Current species:*** *Current operational species (****E. globulus*** *and* ***E. nitens****) generally performed best on the sites with greater than 690 mm/y rainfall.*
- ***Non-current species:*** ***E. botryoides*** *and* ***E. smithii*** *show promise on the drier sites based on biological growth."*

(Duncan *et al*, 2000, p.vii)

Update: If the trials are still available, an updated assessment would provide insights into species performance across Gippsland (e.g. later-age wood properties).

Taking the data for *E. globulus* and site rainfall, a MAI for rainfall function was prepared (Figure 5) based on performance of the best two seedlots in each trial (see Duncan *et al*, 2000, Table 4). The model is robust for the sites included, with an R2 = 77.8%. For example, the data point well below the trend-line (rainfall = 930 mm/y) was on medium to heavy clay soils, which may have reduced tree growth. This relationship can be used to gain an insight into MAI expected for rainfall subject to the limitations noted. The highest productivity sites were ex-pasture sites. It is acknowledged that the trial sites included ex-*P. radiata* plantation sites but site preparation and management was to a high standard (e.g. weed control and fertiliser) partly off-setting any differences to pasture sites.

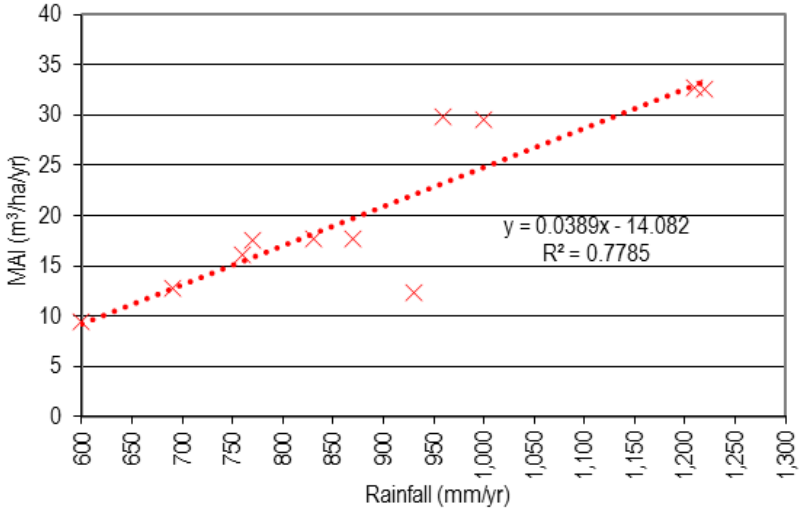



*Figure 5: Average rainfall and MAI for the trial sites for E. globulus. A regression line is presented.*

### *Known older E. globulus plantings*

A 2005 study collected data on productivity of *E. globulus* across Gippsland. Results of a simple sampling process (tree height for age) are presented in Figure 6. Spot height data was superimposed over the Wong *et al* (2000) height for age curves for MAI as indicated. The best result was for Mt Worth at age 16 years (estimated MAI of 30 m³/ha/y) through to the Maryvale site (estimated MAI of 10 m³/ha/y at age 10). The data is highly indicative of actual productivities.

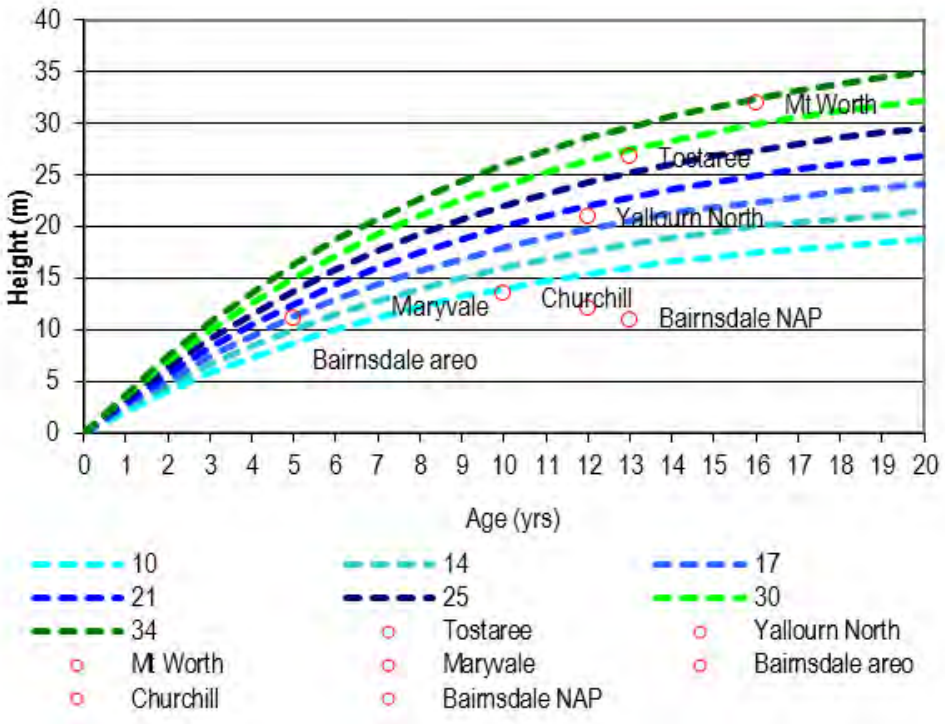



*Figure 6: A series of spot samples of height for age and the indicated MAIs (the dotted lines on the chart).*

### *Red Gum Plains species trial*

In 1999, Gippsland Private Forestry (GPF) commissioned a trial of species with potential to grow on the heavy soils of the Red Gum Plains area (from Sale to Bairnsdale). Sites established in 1999 included clay and more sandy soil types. Sites were deep ripped to 1 m using a D8 bulldozer and good weed control was applied. Figure 7 presents a summary of estimated MAI for the species listed for a clay site (located to the west of Bairnsdale - Bairnsdale's long term rainfall is 630 mm and the actual annual rainfall for the trial period was 621 mm/y). Current operational species for Gippsland are coloured red and indicate an MAI for E. globulus of 10.3 $m^3$/ha/y. Based on the model presented in Figure 1, estimated MAI for a site with 621 mm/y would be 10.1 $m^3$/ha/y.

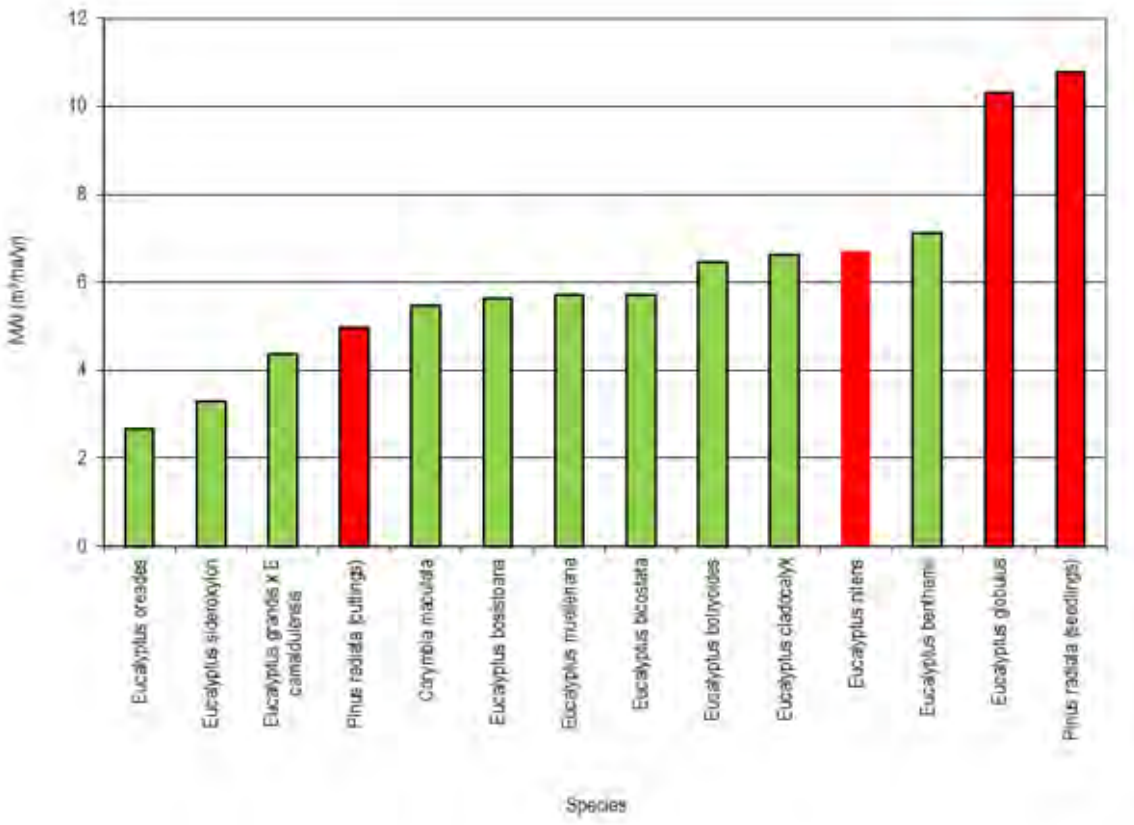



*Figure 7: The outcome of a 2008 assessment of the Red Gum Plains trial at age 9 years. The species marked in Red are current commercial species.*

### *Past studies*

The following studies of plantation potential for land in Gippsland have been completed:

- 1998: A study of the current status of plantation potential studies (Stephens *et al*, 1998).
- 1999: A nationwide ABARES study including Gippsland (Burns *et al*, 1999).
- 2000: A Gippsland specific study by the BRS (Borschmann *et al*, 2000).

The MAI for rainfall assumptions in the 1999 and 2000 studies are presented in Figure 8 with the function presented in Figure 5. With limited exceptions, the 1999 and 2000 assumptions are more bullish compared to the actual data function.

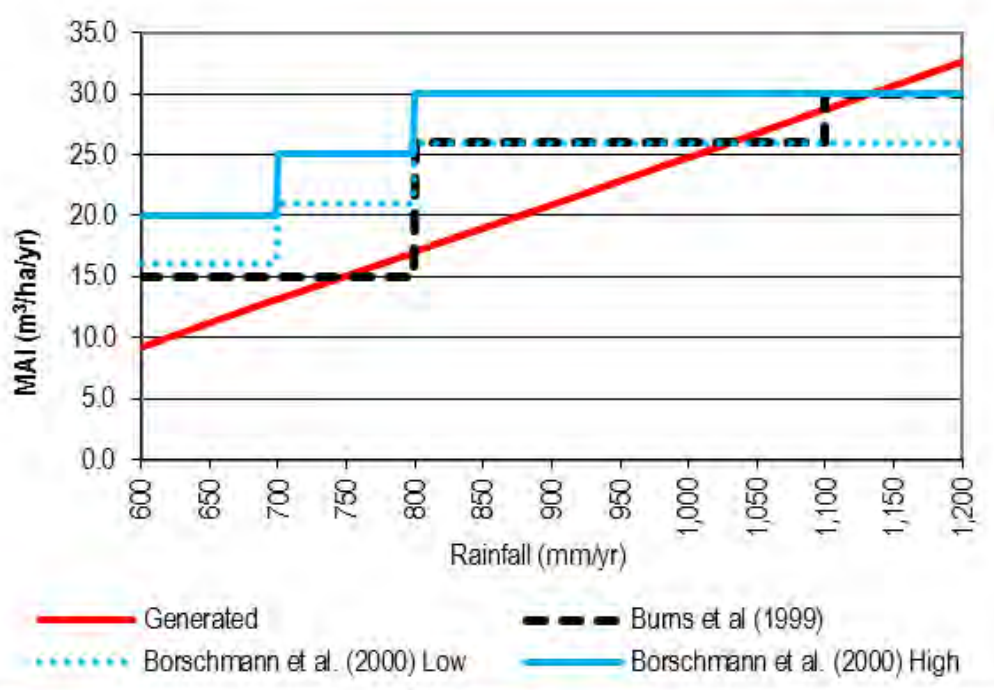



*Figure 8: A comparison of the MAI for rainfall assumptions of the studies indicated and function presented in Figure 1.*

### *Improved productivity through time*

There are a number of often used justifications for why yield predictions are more optimistic for future compared to past plantations:

- **Genetics:** Propose use of better genetics than the previous plantations. If a site is not limited by biophysical attributes, better genetics could assist. It is suggested that more recent plantations had select provenance seed rather than seed from seed orchards. The model presented in Figure 1 represents the outcome of the best two E. globulus provenances at each site.
- **Silviculture:** There is documented evidence of increases in pine plantation yield between crops (due to genetics AND silviculture). However, many lessons learnt from pine silviculture have been adapted and adopted for use in Tasmanian blue gum plantations.

### *Synthesis*

Research undertaken to assess eucalypt plantation productivity in Gippsland indicates mean annual increments (MAI) from 5m³/ha/y to 30m³/ha/y for rotation lengths between 10 to 20 years. This represents a defensible and expected range of growth rates in the region. Importantly species growth rate is strongly correlated with rainfall and inherent soil fertility. When rainfall and inherent soil fertility are then correlated with potentially available land, a defendable assumption is that growth performance of eucalypts plantations will be at the lower end of the range. Therefore, the ABARES applied estimates of potential eucalypt plantation growth rates in Gippsland likely represent a significant overestimate of performance for potentially available land in the region.

# Appendix 2: Stakeholder consultation summary

## Stakeholders consulted[33]

| Organisation | Name | Role |
|---|---|---|
| Gippsland Food and Fibre | Nicola Pero | CEO |
| Victorian Forest Products Association | Deb Kerr | CEO |
| Australian Forest Contractors Association | Carlie Porteous | General Manager |
| Heartwood Plantations | Jon Lambert | CEO |
| Australian Sustainable Hardwoods | Vince Hurley | CEO |
| DEWLP | Judy Alexander | Forest Regulation |
| PF Olsen Australia | David Bennet | Senior Manager |
| Forest Strategy | Gary Featherstone | Owner |
| Wellington Shire Council | Brent McAlister | GM Development |
| Wellington Shire Council | Mark Coleman | Economic Development |
| East Gippsland Shire Council | Sharon Raguse | Economic Development |
| East Gippsland Shire Council | Stuart McConnell | Economic Development |
| AKD Softwoods | Simon Gatt | Resource Manager |
| Baw Baw Shire Council | Melissa Mosley | Economic Development |
| DJPR | Nathan Trushell | Senior Forest Industry Specialist |
| Latrobe Valley Authority | Mike Timpano | Economic Development |
| Agriwealth | Hugh Dunchue | Head Forester |
| Austimber Harvest & Haulage | Ian Reid | Owner |
| ANC Forestry | Daryl Hutton | Owner |
| Leesons | Ricky Leeson | Owner |
| Amber Creek Sawmill | Daniel Bright | Owner |
| Latrobe Forestry and Civil | Travis Healy | Owner |
| AKD | Julian Hay | Dry Mill Manager, Yarram |
| HVP | Chris Barclay | Safety Manager |
| HVP | Bruce Fowler | IT Manager |
| Radial Timbers | Chris McEvoy | CEO |
| DR Richards | Danny Richards | Owner |
| Longwarry Sawmill | Bruce Craig | Owner |
| Powelltown Sawmill | Dan Pote | Manager |
| Mountain Logging | Andrew Mahnken | Owner |
| MJM Excavations | Mark Maiden and Jack Barnes | Owner and Operations Manager |

[33] A total of 67 stakeholders across 49 organisations were invited to participate in consultation for the project. Of these 31 stakeholders from 28 organisations responded to the opportunity.

## Summary of key findings

This section provides an overview of the five key themes identified during the stakeholder consultation process undertaken for the project. This summary has been presented in a manner which de-identifies specific organisations and individuals except where there is an organisation specific issue.

### *View of the future*

Consultation revealed well considered aspirations for the future of the forest and wood products sector in Gippsland. There was also a strong concern for the future expressed, reflecting the level of uncertainty which the sector is facing and the implications of that uncertainty for dependent sectors.

### Growing the whole pie

A theme among stakeholders representing supporting agencies was the concept of creating more value rather than simply changing the way that value is distributed in Gippsland. This theme was considered as applicable to the Gippsland economy as a whole rather than specifically for the forest and wood products sector. Consultation revealed strong theoretical and bureaucratic support for the concept without providing significant detail about how it might be achieved and how it will benefit the forest and wood products sector. However, a useful concept that was considered worth pursuing in relation to this project is that of improving collaboration networks, systems and processes. That applies between commercial enterprises, between private and public sector, between industry and research providers, and across industries. A guiding principle appears to be the view that individual innovation does not grow critical mass.

### Industry transition

The issue of industry transition, as the wind down to the end of public native forest harvesting occurs, was broadly recognised as a concern. Some stakeholders noted that this is part of a broader economic transition for Gippsland, alongside the wind down in coal-based electricity generation. Stakeholders representing supporting agencies (including both local and state government representatives) indicated the need to find alternative roles for forestry businesses, with potentially a focus away from the primary product of manufactured timber towards product expertise. Deeper inquiry related to broad economic transition in Gippsland revealed that there is not much focus from these supporting agencies on the forest and wood products sector when compared with other primary industries. Industry stakeholders are more focused on approaches to address the impact of reduced fibre availability, including a combination of imported fibre and increased focusing on manufacturing value-add. The consultation revealed an apparent disconnect between government sponsored economic transition focus and the needs and aspirations of the forest and wood products sector.

### Small scale private forestry

Consultation revealed broad support for both improved accessibility of private native and plantation forestry and better efforts to support integration of trees into farming systems.

### Circular economy

The establishment of a circular bio-economy in Gippsland is seen as an important and achievable element of an ideal future. Stakeholders noted that the forest and wood products sector is already actively engaged in delivering elements of a circular economy and that this presents a genuine opportunity for industry innovation and transition.

### Infrastructure to support innovation

One view of an ideal future is that all the required infrastructure is in place to support the full cycle of innovation and development from ideation to execution. That requires developing frameworks to identify needs and opportunities for improvement and clarify pathways, including through collaboration.

*Fibre resource*

### Major barrier

The lack of secure and reliable availability of forest fibre resources was broadly identified as the major barrier to innovation for the forest and wood products sector in Gippsland.

### Public native forests

Consultation revealed that the industry is more or less resigned to the fact that the State Government will proceed with its plan to cease harvesting on the public native forest estate and that it will occur much sooner than the nominated date of 2030.

A strong theme which emerged, across all stakeholder groups consulted, was that there will continue to be a need to actively manage some parts of the public native forest estate, including ecological thinning and management for fire. Ideally this would involve the release of some fibre into the future for use by existing industry. The particular focus among those consulted is the silvertop ash forest types, especially in those areas with a history of repeated and intense management. However, stakeholders thought this unlikely to occur, given the State Government's position, despite it making both economic and environmental sense.

### Private native forests

There is some history of private native forestry in Gippsland and potential to generate around 5,000 $m^3$ every two years or so, particularly from regrowth ash forest types. However, there are significant planning and regulatory barriers to expanding access to private native forestry and consultation revealed a lack of transparency and consistency in the way these requirements are applied.

### Plantations

The softwood plantation estate is significant and relatively stable. Despite the State Government's Gippsland Plantation Investment Program, stakeholders expressed considerable scepticism about the likelihood of meaningful softwood plantation expansion in Gippsland, given the recognised issues with land availability, suitability and affordability. It was noted that, regardless of the success of that program, results are at least 30 years away with respect to production of higher value sawlogs at any meaningful scale. Radiata pine is seen as the most suitable softwood species for Gippsland.

The hardwood plantation estate in the region is changing and reducing, either by reversion to agriculture or conversion to other species (high value eucalypt species or radiata pine). Hardwood plantations are not viewed favourably by industry stakeholders as a replacement for native forest because of the length of time required to produce higher value sawlogs (at least 40 years) and because of the relatively small area involved.

### Integration of trees into farming systems

There is broad recognition of the value of improving the rate of integration of trees into farming systems, regardless of the motivation. Identified drivers for this include commercial timber production, improved on-farm productivity and other environmental benefits, including carbon, ecology and water management.

A major barrier to achieving these outcomes is the perception of a trade-off between timber production and food production, with timber seen by many as an incompatible land use decision in prime agricultural areas.

*Processing and markets*

Markets for logs and manufactured wood products are dynamic. The largest market is OPAL which is in the process of moving from fine white papers to packaging that will naturally rely on a higher proportion of softwood fibre than the historic focus on hardwood fibre.

Current hardwood processors are highly innovative. For example, ASH, Radial Timbers, Amber Creek and Fenning Timbers are all seeking to innovate with respect to both log products sourced (species, location) and end products produced (increased value-ad to componentry, different sawing processes etc). Expansion of operations is limited by what is securely and reliably available with respect to fibre resource. This was also raised as an issue for smaller softwood processors operating in the non-structural sawn and preservation markets.

Harvest and haul contractors and competing mills indicated their perception that not much of the sawlog quality fibre produced in Gippsland is making it to a sawmill, the inference being that considerable value is being lost. Regardless, there are strong indications of inter-regional woodflows and swaps occurring of softwood - both pulpwood and sawlogs. Similarly, hardwood logs, flitches, cants and sawn timber are being imported to regional manufacturers from Tasmania, New South Wales and overseas.

The large majority of the Tasmanian blue gum grown in Gippsland, appears to be transported to Geelong for chipping and export.

***Infrastructure***

### Harvesting

Plantation design must importantly consider infrastructure. It is essential that sites are set up well for access by harvesting machinery and haulage systems. This also has implications for the nature of sites selected for plantation establishment. Stakeholders identified potential planning and regulatory barriers to future harvest due to inconsistent application of the regulatory framework by local government authorities. Careful consideration must be given for both industrial and small scale plantation establishment. For smaller scale operators (e.g. where trees are integrated into farming systems), this is even more important because it affects confidence to invest in an environment where the cost profile is already higher.

### Haulage

The roads and related infrastructure in Gippsland are generally considered to be relatively good overall. However, topography, soils and rainfall are limiting in some areas with respect to the potential range of haulage systems that can be economically deployed in the region. Plantation internal roads and local government roads particularly, as well as state managed roads in some instances, will define (by limitation) truck configuration options. The ideal standard for log haulage is B-double or larger, in order to drive haulage productivity and reduce costs and safety risks associated with a higher number of freight trips. Although optimal in some steep or niche conditions, there are still many single bogie and folding skel trucks in use in the regions. Mini-B-doubles and other combination configurations may have greater potential.

### Roads and related infrastructure

As noted, the general view is that the road infrastructure in Gippsland is reasonably adequate for the forest and wood products sectors' requirements. Some specific issues were identified through consultation, including:

- Dual carriageway options for the Hyland Highway
- Specific intersections that would benefit from realignment to improve entry or line-of-sight challenges.
- Specific bridges where load limits are restricting.
- Consideration of a better road transport solution to link the coast to the Latrobe Valley.

Consultation revealed that the sector has a long history of building or contributing funds to road infrastructure which is later adopted for broader community use, such as Tamboritha Road and Brodribb Road.

The industry is also mindful of the fact that log trucks share large parts of the road network with general traffic and freight users from other sectors which may require consideration of traffic management systems.

### Ports

In broad terms, stakeholders recognised the presence and potential value of Gippsland's considerable port infrastructure, which is currently underutilised. There were views put forward about the use of the ports for both inward-bound raw materials and outward bound finished products. A key consideration is improving the links between the port infrastructure and the road and rail infrastructure, particularly roads.

### Rail

OPAL currently utilises rail for the transport of finished products from Maryvale to Docklands, for export, and to other domestic markets. Fenning Timbers has received funding from the State Government to establish an intermodal facility at Bairnsdale to support transport of timber and other primary produce from Gippsland. However, there is scepticism among industry players about the utility of rail as a transport option for the Gippsland timber industry generally due to the cost of double-handling, lack of scale and challenges to be addressed at both ends of the rail freight task.

### Communication, data and energy infrastructure

A number of stakeholders noted challenges with reliable access to electricity required for manufacturing processes. Of particular concern is the perceived lack of maintenance of the poles and lines network and concern that electricity providers are attempting to pass on the cost of routine maintenance and upgrades to users, such as timber processors. There is also a concern that the reduction in coal-powered electricity production will result in increasingly unreliable baseload power availability as the electricity sector moves to renewables.

Communication and data networks are considered patchy and broadly unreliable, particularly in-forest and outside the major urban areas in Gippsland. This is viewed by stakeholders as a challenge on two fronts:

- The ability to fully embrace technology in the form of active application of real-time data transfer.
- Implications for safety and fire management.

The issue is also exacerbated by the electricity supply challenge. For example, when there are significant power outages, rural telecommunications access is compromised because the batteries used as back-up for telecommunications towers are either inadequate or not well maintained to do the required job.

***Innovation***

### Barriers

The primary and overwhelming barrier to innovation which was identified by stakeholders is secure, reliable access to wood fibre. There is a view held by some stakeholders that State Government efforts aimed to increase fibre availability are all targeted at sustaining operations at Maryvale – a view supported by the Government's own Forestry Plan. Industry stakeholders queried where the rest of the processing sector fits in that arrangement and what is the incentive to innovate?

### Focus areas and opportunities

Consultation revealed a strong focus on the front end of the supply chain. This relates strongly to the previous point. If wood fibre availability is the barrier, then the focus for innovation should rightly be on how to improve its availability, reduce its cost and ensure that it is fully utilised and valued appropriately. Stakeholders identified innovation in haulage as a significant opportunity to exploit, along with technological and telecommunications innovation to support enhancement of logistics and systems processes.

Consideration of alternative harvest and haul regimes, such as in-field chipping, may also present opportunities to improve resource recovery and utilisation, along with networked multi-use infrastructure at a site such as Maryvale (e.g. on-site sawmill) or an industry merchandising manufacturing/freight transit hub.

Similarly, innovations in primary processing that assist sawmillers to deal with a changed 'log diet' are seen as important. Technology that deals with smaller diameter, shorter and more poorly formed logs, sometimes with less desirable wood properties, is an important means of maximising wood utilisation. Industry stakeholders noted that investment in this technology, particularly when combined with artificial intelligence and automation, can result in very good investment pay back and improve access to required fibre volumes.

A 'soft infrastructure' innovation relates to the opportunity to improve supply chain collaboration on shared issues. One example provided during the consultation process was the work of the Softwoods Working Group in the south-west slopes region of NSW, or the Green Triangle Forest Industry Hub both of which have had considerable success in addressing whole of industry challenges such as road and port infrastructure.

### Innovation processes

There are a growing number of software packages and formal management and culture change processes available to facilitate development of projects and innovation, some of which are being introduced by a number of stakeholders. One which is currently used in Gippsland is the Smart Specialisation (SS) process developed by the European Union. The Latrobe Valley Authority is applying a Smart Specialisation Strategy (S3) methodology via the University of Melbourne's Sustainable Society Institute to bring together '*...government, business, research and education and civil society to co-design a shared vision for the region's future prosperity, environmental sustainability and social wellbeing*'. This process includes a quadruple helix stakeholder engagement . The importance of such engagement is noted as process of stakeholder engagement that is voluntary, open, and with active dialog, to identify the current position of all parties included, outlines objectives and outcomes and identifies how to achieve them. Parties that are included in the engagement can change but the process of engagement continues.

### Requirements for confidence to innovate

There are generic issues underpinning confidence to innovate.

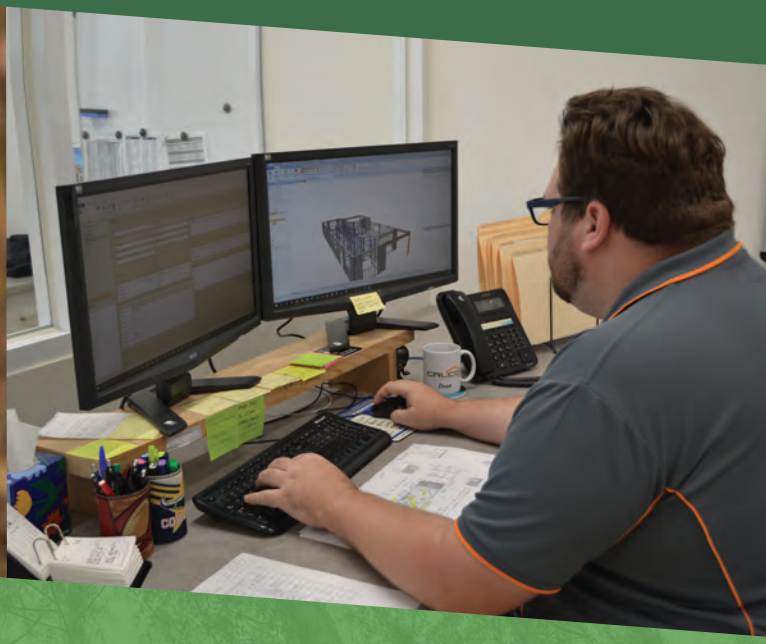
- **Business structures:** Innovation within companies can be assisted by entity structure; for example, a real board and commercial structure allows a company to innovate.
- **Log quality:** A change in log quality either due to adjustment of log specifications, silviculture or genetics can change the volume of each product mix.
- **Economies of scale:** Processors require economies of scale to be able to innovate; more so in a commodity market space with softwoods.
- **Financial security likelihood:** achievable margin and term of supply and service contracts

There are specific issues associated with the hardwood processing sector.

- **Resource supply:** Investment in innovation requires confidence that underpinning resources will remain available in regard to quantity and quality of that supply. This can include long-term contracts; historically this was via c.15 year timber licences. This is regarded as the primary issue.
- **Government policy:** The existence of supportive Government policy provides confidence to innovate. Indeed it is more consistency and durability of policy that is critical.
- **Activism:** While legal resource supply underpinned by robust and consistent Government policy is possible, there has been a long history of risk of activists influence and changing an ability to harvest.

Gippsland's softwood processing sector, while processing a different resource, requires resource certainty to encourage innovation. That said there has been some innovation.

- **Resource security:** While softwood resources exist in Gippsland, certainty of access can be compromised. For example, export markets have soaked up surplus volumes given the exporters capacity to pay. While currently of lesser an issue, it remains as a driver of uncertainty.
- **Products**: A full range of softwood products already, many of which are commodities.
- **Supply gap:** There is a current supply and demand gap exacerbated by a lack of plantation expansion; not enough resources to match needs of the processors.



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