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NERA ECONOMIC CONSULTING

Forestry Corporation of NSW

HFD Harvest and Haul Audit

Final Report

18 September 2017

Melbourne

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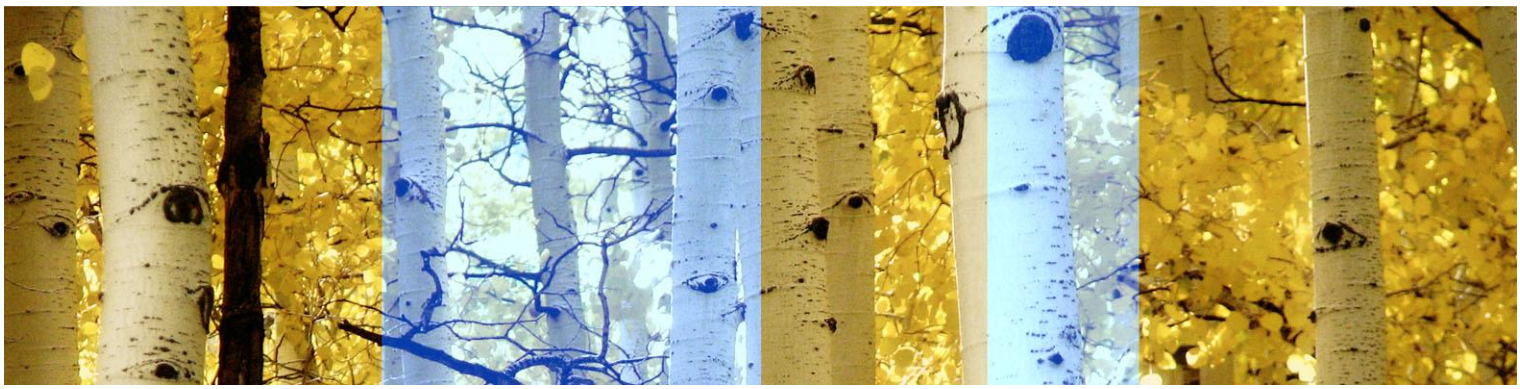

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PREFACE

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EXECUTIVE SUMMARY

Forestry Corporation of New South Wales (FCNSW) is a State Owned Corporation and the largest producer of logs harvested from commercial native and hardwood plantation forests in NSW. The purpose of this report was to undertake a review and benchmarking of FCNSW's mill door native timber harvest and haul costs for the period 1 July 2013 to 30 June 2016. This review is a legislative requirement under Section 91 (1) of the Forestry Act 2012 and specifies that FCNSW review its native timber and harvesting and haulage costs and benchmarks these costs against similar organisations undertaking similar native timber harvesting and haulage operations.

Indufor and NERA Economic Consulting were engaged by FCNSW to undertake this independent review. The scope of the review completed for this report was the following:

- *Benchmarking* - for the period 1 July 2013 to 30 June 2016, for those native timber harvest and haul operations where FCNSW directly engages the contractor and establishes rates for service (delivered sales):
    - Review FCNSW's native timber harvest and haul costs, including FCNSW's costs of administering harvest and haul operations
    - Benchmark these costs against the costs of similar organisations undertaking similar native timber harvesting and haulage operations
    - Additionally, other techniques such as total or partial factor productivity and dynamic envelopment analysis should be considered and employed, if feasible; and
    - Consider stumpage operations as a cost comparison and whether stumpage arrangements are potentially more cost effective than harvest and haulage contracting
- *Market power* - examine the extent of any market power within local or regional markets for harvesting and haulage services
- *Cost recovery* - comment on whether FCNSW recovers the full cost of harvest and haul expenses and the cost of administering these contracts.

The findings and recommendations of this report are outlined as follows.

Benchmarking

The industry benchmarking analysis of FCNSW's native timber harvest and haulage costs was undertaken in two parts:

- Unit cost comparison for the period 2013 – 2016
- Analysis of cost drivers through the development of productivity cost models.

The data and information that was collected and applied to the benchmarking analysis comprised the following:

- FCNSW sales data

- FCNSW cost data by activity to determine unit costs for harvest and haulage
- Procurement/tendering information and contracted rate outcomes for both FCNSW and other available jurisdictions.

The findings of the benchmarking analysis were as follows:

- *Harvest rates* - given the different operating and commercial environments, harvesting operations display high degrees of customization both within FCNSW operations and in contrast to other jurisdictions. Given this, it has proven difficult to precisely compare FCNSW harvesting rates to other markets and that inter-jurisdictional data primarily provides directional guidance as to comparator rates. Whilst the observed rates in the four identified geographic markets in which FCNSW procures harvesting services appear higher than other jurisdictions, there are market specific factors influencing operating costs that can be attributed to the higher harvest rates in NSW. We do note that the harvest rates over the three years covered by this review have increased at a lower rate than the CPI over the relevant period, and that rates across the regions of NSW are comparable; and
- *Haulage rates* – haulage operations have been easier to benchmark given haulage operations are more comparable across jurisdictions. Based on the available data our findings are that FCNSW's haulage costs are within the ranges observed across comparable operations.

The additional analytical techniques that we identified as potentially applicable to benchmarking FCNSW's native timber harvest and haul costs were the following:

- Productivity indexes;
- Data envelopment analysis (DEA); and
- Stochastic frontier analysis.

The feasibility of applying these to FCNSW costs is dependent on the following factors:

- The availability of multiple useful comparators, and information on other comparators (i.e. the ability to create a productivity index for other harvest and haul operators and sufficient comparators in order to produce an 'efficient frontier');
- The degree to which FCNSW's operations and their comparators operations are affected by large, one-off events (e.g. extreme weather, bushfire);
- The availability of highly accurate data on inputs and outputs including both price and quantity data; and
- Having a sufficiently large and varied sample size to estimate statistically significant results.

Suitable datasets of these types were not being collated at during the period 2013-2016, and therefore analysis of this type was not able to be completed. The potential future application of additional

benchmarking techniques will be dependent on the availability of more comprehensive data and information in relation to harvest and haul operations.

Market Power Assessment

Assessment of the extent of any market power within local or regional markets for harvesting and haulage services was based on the following steps:

- *Market definition* – identifying the relevant market for harvest and haulage services including the different dimensions of the market
- *Market analysis* – analysis of the current state of the harvest and haulage market including operating arrangements, barriers to entry and participants (including market shares); and
- *Market power assessment* – evaluating the extent of any market power in harvest and haulage services by assessing the structure of the market, trends in market concentration and commercial outcomes.

The activity and trend data in relation to the number of operators participating in FCNSW's procurement processes indicate a level of contestability for the provision of harvest and haulage services in the markets identified, recognising FCNSW is the primary purchaser of these services. To consider whether there may be market power within local or regional markets for harvest and haulage services the following was considered:

- The trends in market concentration for the provision of harvest and haulage services in the identified geographic markets
- The current market structure and basis on which harvest and haulages services are procured by FCNSW; and
- Pricing for harvest and haulage services over the three year period considered for this review.

Based on the available data and information in relation to these three areas, the findings of the report were that the market for the provision of FCNSW's harvest and haulage services appear to result from a contestable process, albeit from within a managed market. In addition, the analysis of the market concentration trends and pricing outcomes over the three year period covered by the review do not appear to highlight potential market power in local or regional markets.

Cost Recovery

FCNSW are entitled to recover costs of third party contracted harvesting and haulage services, and the administration of those services. The delivery charge revenue, accruing over the three year period was compared to the delivery charges that include the administration fee that recognises FCNSW costs. Total revenue was higher than the contracted costs over the period, however only a portion of the administration costs were recovered. There may be a number of explanations for this, including:

- The methodology to calculate FCNSW costs may overstate the proportion of FTE's associated with managing mill door sales.

- Whilst FCNSW may include administration charges in the calculation of total delivered log prices for some customers, the accounting methodology may only allocate contract costs to the delivery charge of the total log price.
- FCNSW is underestimating the expected delivery charge, including the administration component. This may arise if more expensive contractors are assigned to harvest areas over the course of the year, or plans change due to unforeseen circumstances such as wet weather.

In summary, FCNSW delivery charges appear to be commensurate with third party contracted costs over the three year period overall, however from the data available, only a minor part of the administration cost appears to being recovered from the delivery charge.

Summary of Findings

FCNSW costs for harvesting services for the period under consideration are higher than that evident from inter-jurisdictional operations, however appear to be reasonable on the basis that;

- Increases are largely less than CPI over the review period
- Operating conditions are significantly different within and between the jurisdictions, and appear to explain a proportion of the higher costs in NSW
- The market appears to be reasonably competitive and FCNSW are actively managing procurement processes to ensure contracted parties are operating efficiently and they are achieving a clear indication of price discovery for these services.

FCNSW costs for haulage services are commensurate with other native forest operations.

FCNSW administration costs appear to be commensurate with comparable operations. From the data provided, FCNSW do not appear to be fully recovering both contract and administration costs through the application of delivery charges.

Recommendations

Based on our findings above, our recommendations on the options for enhancing the capacity for FCNSW to benchmarking its harvest and haulage costs in the future are the following:

- ***Procurement processes –*** FCNSW consider the development of a systematic and consistent approach to the collection and reporting of data and information in relation to its procurement of harvest and haulage services including: tender details, tender specification, bidder participation and contracts awarded (including rates). This could involve a summary table from tendered or negotiated outcomes that could directly inform an analysis of the functioning of the market.
- ***Cost data –*** FCNSW work towards the development of standardised cost data set for its harvest and haul operations by: contract, product, market, price and volume.

- ***Alternative approaches –*** FCNSW consider capturing additional data that may support the development of alternative approaches to benchmarking such as data on inputs and outputs of harvesting and haulage.
- ***Inter-jurisdictional data –*** FCNSW further examine the feasibility and value of collecting additional data from other jurisdictions to provide the basis for the development of other benchmarking techniques such as productivity indexes in the future; and
- ***Cost recovery –*** FCNSW give consideration to ensuring the financial monitoring and reporting systems appropriately capture and allocate costs and revenues associated with managing mill door sales to ensure that future comparisons with cost recovery and the administration burden of alternative sales arrangements can be made.

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INTRODUCTION

1.1 Purpose of the Report

Forestry Corporation of New South Wales (FCNSW) is a State Owned Corporation (SOC) and the largest producer of commercial native and hardwood plantation forests in NSW. The purpose of this report was to undertake a review and benchmarking of FCNSW's mill door native timber harvest and haul costs for the period 1 July 2013 to 30 June 2016. This review is a legislative requirement under Section 91 (1) of The Forestry Act 2012.

> ***Harvesting and haulage costs review***
> *(1) As soon as practicable after the first 3 full financial years after the commencement of this section and every 3 financial years thereafter, the Corporation is to:*
>
> *(a) review its native timber harvesting and haulage costs, and*
>
> (b) *prepare a report on the results of the review that benchmarks those costs against the costs of similar organisations undertaking similar native timber harvesting and haulage operations.*

1.2 Scope

The scope of the review completed for this report incorporated the following three aspects.

1.2.1 Benchmarking

For the period 1 July 2013 to 30 June 2016, for those native timber harvest and haul operations where FCNSW directly engages the contractor and establishes rates for service (delivered sales):

- Review FCNSW's native timber harvest and haul costs, including FCNSW's costs of administering harvest and haul operations
- Benchmark these costs against the costs of similar organisations undertaking similar native timber harvesting and haulage operations
- Additionally, other techniques such as total or partial factor productivity and dynamic envelopment analysis should be considered and employed, if feasible; and
- Consider stumpage operations as a cost comparison and whether stumpage arrangements are potentially more cost effective than harvest and haulage contracting.

1.2.2 Market Power

Examine the extent of any market power within local or regional markets for harvesting and haulage services.

1.2.3 Cost Recovery

Comment on whether FCNSW recovers the full cost of harvest and haul expenses and the cost of administering these contracts.

1.3 Approach

The approach that was adopted for preparing this report was based on the steps outlined below:

NSW native forestry overview

The preparation of an overview of the NSW native timber industry covering the following elements:

- Size and geographic location of the commercially available native timber resource in NSW
- Native timber products and customers
- The structure of the supply chain and commercial arrangements
- Key market trends and dynamics relevant to the current state and future of the native forestry sector.

Conceptual log harvesting and haulage model

To provide a basis for identifying the relevant data and information for the benchmarking exercise, the development of a conceptual log harvesting and haulage cost model incorporating:

- Harvesting
- Haulage.

Data collection and review

The collection and review of the identified data and information including:

- FCNSW sales data
- FCNSW cost data by activity to determine unit costs for harvest and haulage
- Procurement/tendering information and outcomes for both FCNSW and other available jurisdictions.

Benchmarking analysis

The industry benchmarking analysis has been undertaken in two parts:

- Unit cost comparison for the period 2013 – 2016
- Analysis of cost drivers through the development of productivity cost models.

The analysis also includes the consideration of a selection of additional analytical approaches to benchmarking that could be applied in the future to benchmark FCNSW's native timber harvest and haul costs.

Market power assessment

Assessment of the extent of any market power within local or regional markets for harvesting and haulage services based on the following:

- *Market definition* – identifying the relevant market for harvest and haulage services including the different dimensions of the market
- *Market analysis* – analysis of the current state of the harvest and haulage market including operating arrangements, barriers to entry and participants (including market shares)
- *Market power assessment* – evaluating the extent of any market power in harvest and haulage services by assessing the structure of the market, trends in market concentration and commercial outcomes.

Cost recovery analysis

The identification of all costs associated with the harvesting, hauling and administration of managing mill door deliveries, and comparing these costs with any revenue generated from log sales specifically as a delivery charge, as distinct from stumpage or log royalty.

1.4 Report Structure

The structure of this report is as follows:

- Section 2 provides an overview of the native timber industry in NSW
- Sections 3 and 4 details the benchmarking analysis and consideration of additional analytical approaches
- Section 5 outlines the market power assessment and conclusions on the extent of any market power within local or regional markets for harvest and haulage services
- Section 6 provides comments on whether FCNSW recovers the full cost of harvest and haul expenses and the cost of administering these contracts
- Findings and recommendations are included in Section 7.

2. NSW NATIVE TIMBER INDUSTRY OVERVIEW

The timber industry in NSW encompasses the growing and harvesting of trees within the forest estate, and the transport of logs, manufacturing and distribution sectors. It includes operations based on plantations and native forests, located on state forest, other public land and private property.

2.1 Resource

There are 26.5 million (M) hectares (ha) of forest in NSW, of which FCNSW manage 2.2M ha. Of this, approximately 0.24M ha is softwood and hardwood plantation, the balance being native forest. Approximately 1.3% of the native forest land within the FCNSW estate are harvested annually[1].

Table 2-1: Forest Area

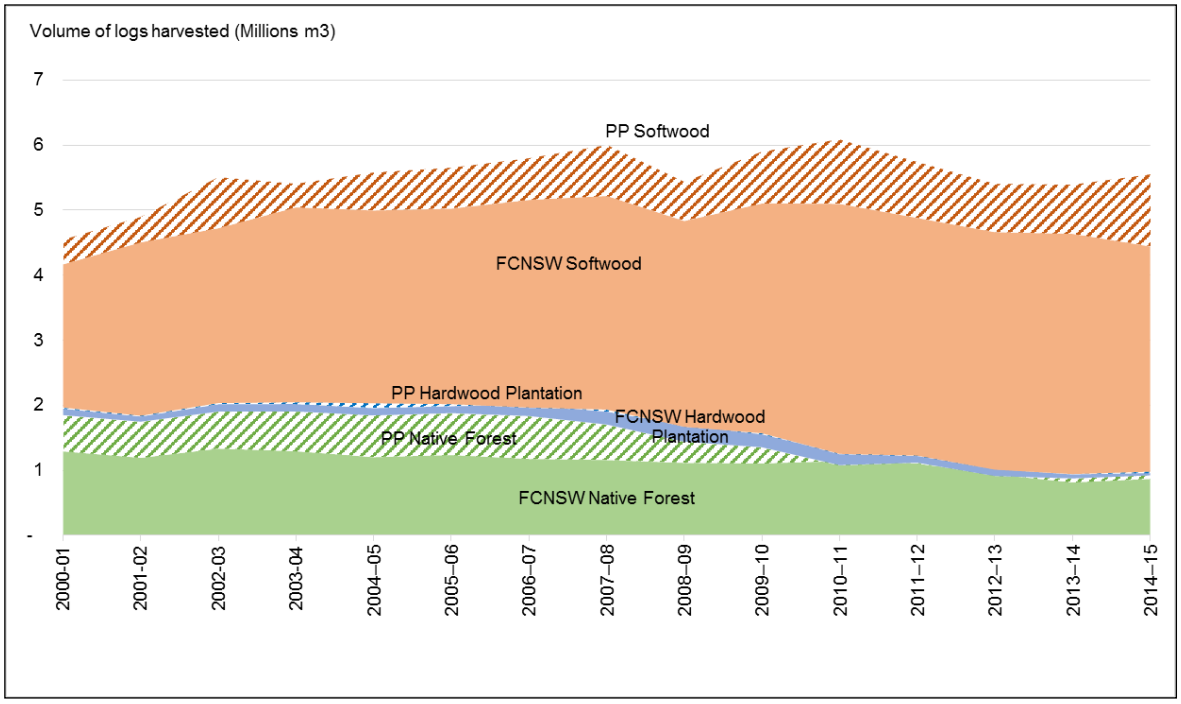
	Area (million ha)		
Description	**Australia**	**NSW**	**FCNSW**
Total land area	770	80	2.2
Total forest area	149	26.5	2.2
Native forest area	147	26.2	1.9
Native forest in formal conservation areas	22	5.1	0.02
Net plantation area	2	0.37	0.24

Source: Forests NSW Facts and Figures 2011-12

As is evident from Figure 2-1, of the total log harvest in NSW, approximately 16% arises from harvesting of native forests. Of that, over 90% is supplied from public forests managed by FCNSW.

[1] Forests-NSW-Facts-and-Figures-2011-12

Figure 2-1: Total log harvest NSW 2000/01 – 2014/15*

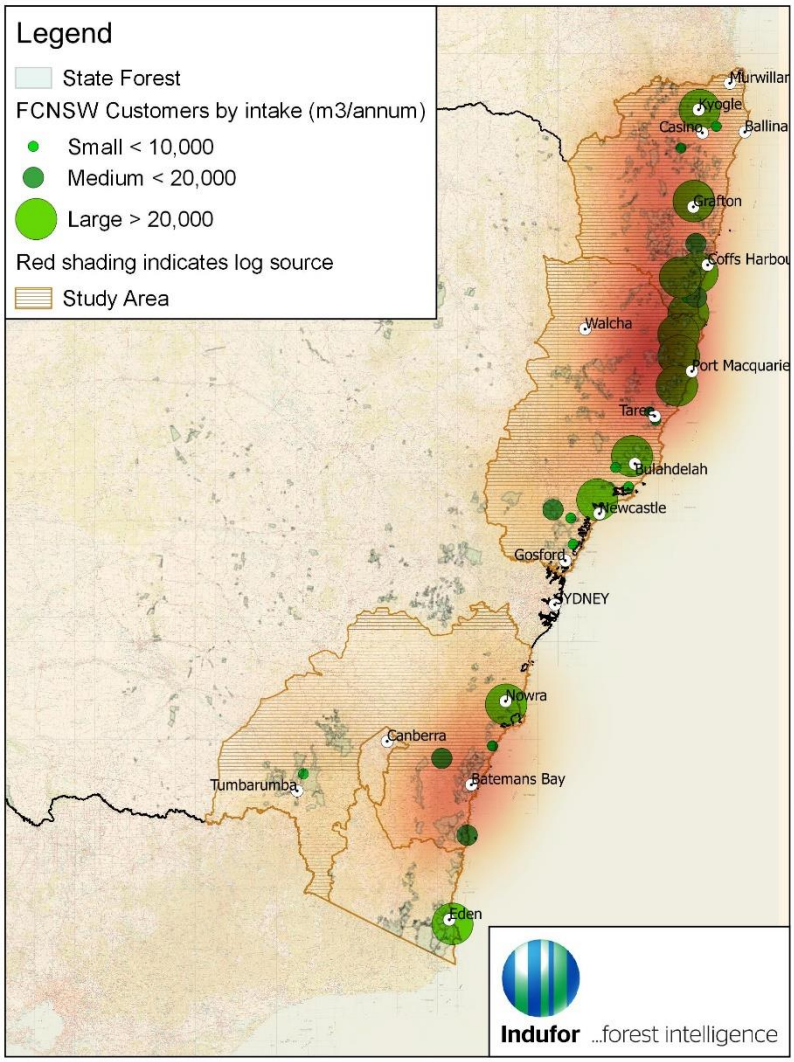


Source: ABARES, FCNSW

*Note – Indufor understands the private native forests volume has been derived from the difference between the ABARES estimate of total native forest volume less log volume reported annually by FCNSW. The decline to almost no private property volume does not fully reflect the current situation, which may arise due to a lack of reporting through to ABARES.

FCNSW manage log production and sales in two broad geographic zones based on forest north of Sydney, and those south to the Victorian border. Map 2-1 illustrates the distribution of customers and the red shade represents the log supply zones (where the darker red colour reflects increasing levels of activity).

Map 2-1: FCNSW customers and log source by location*



Source: FCNSW *Note – excludes sales sold on a stumpage basis

2.2 Products

The NSW forest industry supplies a number of finished products to the domestic and international market. The following table highlights the major finished products and related forest type from which the logs are sourced.

Table 2-2: Timber Products

Product Description	Hardwood (Native forest and plantation)	Softwood Plantation
Sawn timber	Heavy construction, flooring, furniture	Framing, industrial, furniture
Plywood	Flooring, construction	Construction, formwork
Composite Products	Cladding	Particleboard, MDF
Pulp and paper	Fine paper (export markets)	Newsprint, packaging
Firewood and biofuel	Domestic, industrial	Industrial

2.3 Timber Production Supply Chain

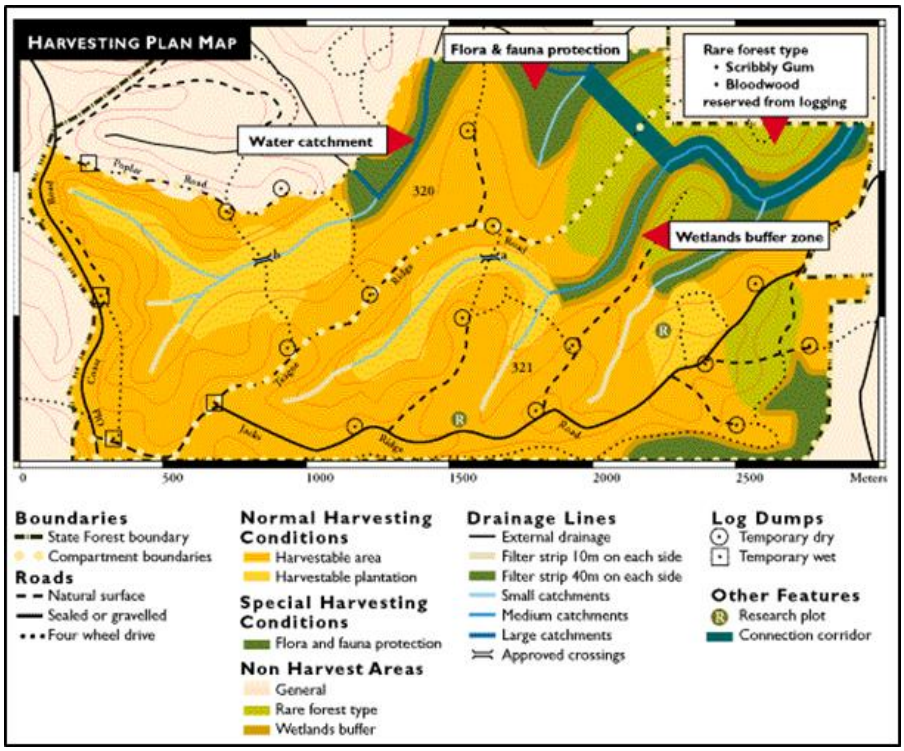
The supply chain for the industry constitutes:

- activities by the forest management and growing
- log production operations including road and track construction, harvesting and haulage
- primary processing by sawmills, chipmills, pole producers
- secondary processing by board and paper manufacturers
- downstream processing by truss and frame producers, furniture manufacturers
- timber sales and distribution to wholesalers and retailers.

The following describes the activities broadly undertaken by the forest grower in relation to log production – primarily harvesting and haulage, the key areas subject to this report.

Forest management and growing – includes activities to establish, enhance and protect the forest crop and manage for multiple values including recreation, biodiversity and water production. Roading and harvesting operations are planned in advance to ensure the protection of environmental values and prescribe the type of operations that will optimise the economic and silvicultural outcomes. These planning processes result in the production of a harvest plan, as shown in Figure 2-2, which defines the location of the various harvest and non-harvest areas.

Figure 2-2: Example harvesting plan map



Source: FCNSW

Road and track construction - access to the forest is provided via existing road and trail networks. In some cases, new roads may be required to optimise the efficiency of the harvesting and transport operation (see Plate below). Minor roads may be the responsibility of harvesting contractors, but in most cases are provided by the forest grower. Snig tracks are constructed as part of the harvesting operation, usually on a temporary basis, and as such are required to meet specific drainage and rehabilitation requirements.

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Plate 2-1: Road construction – track recently widened and drained

Source: FCNSW

Tree felling, extraction, log making and storage – the harvesting operation can be broken down into different phases of tree felling, skidding the logs to roadside and log grading and roadside storage. This is generally performed by a single contract entity using multiple purpose-built machines.

Tree felling was historically completed by hand felling with chainsaws or axes, and now is increasingly being completed by machines (see following Plates). These changes to machine felling have been due to both significant enhancements in the safety performance of the operations as well as potential for increasing efficiency of operation.

Log skidding is done by machine, featuring a range of machine configurations that vary by operation characteristics. The following plate note these variations.

Plate 2-2: Manual tree felling

Plate 2-3: Mechanical tree felling

Plate 2-4: Snigging logs (winch)

Plate 2-5: Skidder with grapple

Source: FCNSW

In the NSW context, trees from a single harvesting operation may be cut into multiple log products, depending on the species, dimensions (diameter and length), defect (branches, rot, gum vein) and available markets. This can include high quality logs for sawmilling and peeling, lower quality logs for milling into industrial grade lumber, logs for exporting both whole and as woodchips, and for domestic firewood (Figure 2-3 and following plates).

Figure 2-3: Harvesting process

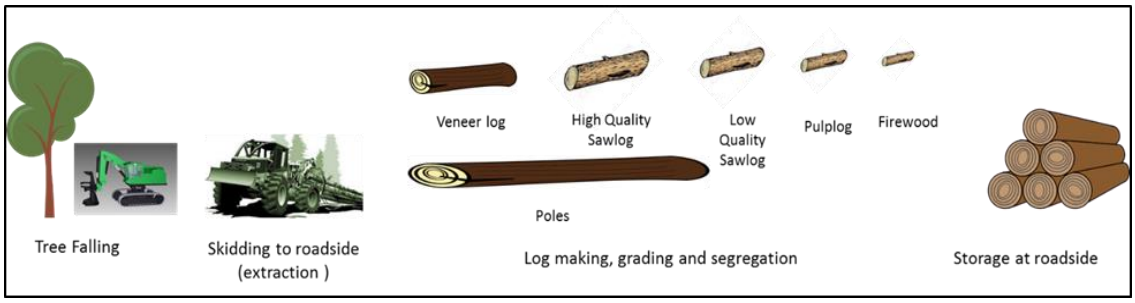


Plate 2-6: Log making with chainsaw

Plate 2-7: Log making with harvester

Source: FCNSW

Loading and transport – in native forest operations loading is generally performed by the harvesting contractor. Haulage can be performed by either the harvesting contractor, a separate but related entity, or an independent party.

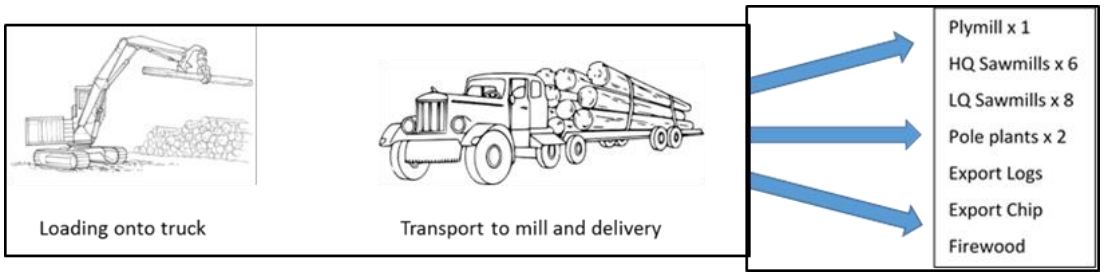
Plate 2-8: Log loading in progress

Plate 2-9: Loaded log truck exiting forest

Source: FCNSW

Loading of the operations are arranged to deliver differing log qualities to differing customer requirements, with each truck usually loaded with a single log product (Figure 2-4).

Figure 2-4: Log loading and distribution process (NSW North Coast example)



2.4 Commercial Arrangements

The primary commercial relationship underpinning log supply are supply contracts between FCNSW and log customers that may range in term from casual – short term through to 20 year Wood Supply Agreements (WSA). The key current contracts in place are tabled below, along with the key products being sold, the contract terms and the basis of the sale.

Table 2-3: Log Supply Arrangements

Company	Mill locations	Product	Contract Term	Sale Type.	Allocation Total
Allied Natural Wood Exports	Edrom	Pulplog	1999 - 2018	Stumpage	**329,000**
Boral Timber	Koolkhan (Grafton), Herons Creek, Kyogle	High Quality Sawlogs	2004 - 2028	Mill door	**163,000**
	Narooma, Nowra	High Quality Sawlogs	2001 - 2020		
Thora Sawmilling Pty Limited	Thora	High Quality Sawlogs, Low Quality Sawlogs	2004 - 2023	Mill door	**42,627**
Kempsey Timbers (Sawmilling) Pty Ltd	West Kempsey	High Quality Sawlogs, Low Quality Sawlogs	2004 - 2023	Mill door	**8,123**
Newells Creek Sawmilling Co. Pty Ltd SA Relf & Sons Pty Ltd	Bulahdelah	High Quality Sawlogs, Low Quality Sawlogs	2004 - 2023	Mill door	**24,807**
Blue Ridge Hardwoods Pty Ltd	Eden	High Quality Sawlogs	1999 - 2018	Stumpage	**24,000**
Adams Sawmills Pty Ltd	Bonville	Low Quality Sawlogs	2004 - 2023	Mill door	**21,863**
Hurford's Building Supplies Ltd	Kyogle, Casino, Karuah, Tuncester	High Quality Sawlogs, Low Quality Sawlogs	2004 -2023	Mill door	**21,753**
Koppers Wood Products Pty Ltd	Junction Hill	Poles and Piles	2004 -2023	Mill door	**20,260**
Aquafern Pty Limited	Warrell Creek	Low Quality Sawlogs	2017	Mill door	**18,000**
Hayden Timbers Pty Ltd	Telegraph Point	Low Quality Sawlogs	2023	Mill door	**17,925**
CJ & A Woods Pty Limited	Nambucca	High Quality Sawlogs, Low Quality Sawlogs	2023	Mill door	**17,170**
J Notaras & Sons	Grafton	High Quality Sawlogs, Low Quality Sawlogs	2004 -2023	Mill door	**16,579**
Big Rivers Timbers	Junction Hill	Veneer Logs	2004 -2023	Mill door	**16,502**
Weathertex Pty Ltd	Heatherbrae	Pulplog	2023	Mill door	**15,000**
Ryan & McNulty Pty Ltd	Benalla	High Quality Sawlogs	2004 - 2020	Mill door	**12,500**
Romney Park Sawmill Pty Ltd	Ulladulla	High Quality Sawlogs, Low Quality Sawlogs	2020	Mill door	**5,886**
Leonard J Williams (Timber) Pty Ltd	Bucca	Poles, Piles, Girders, High Quality Sawlogs, Low Quality Sawlogs	2023	Mill door	**5,035**
Other					**40,797**

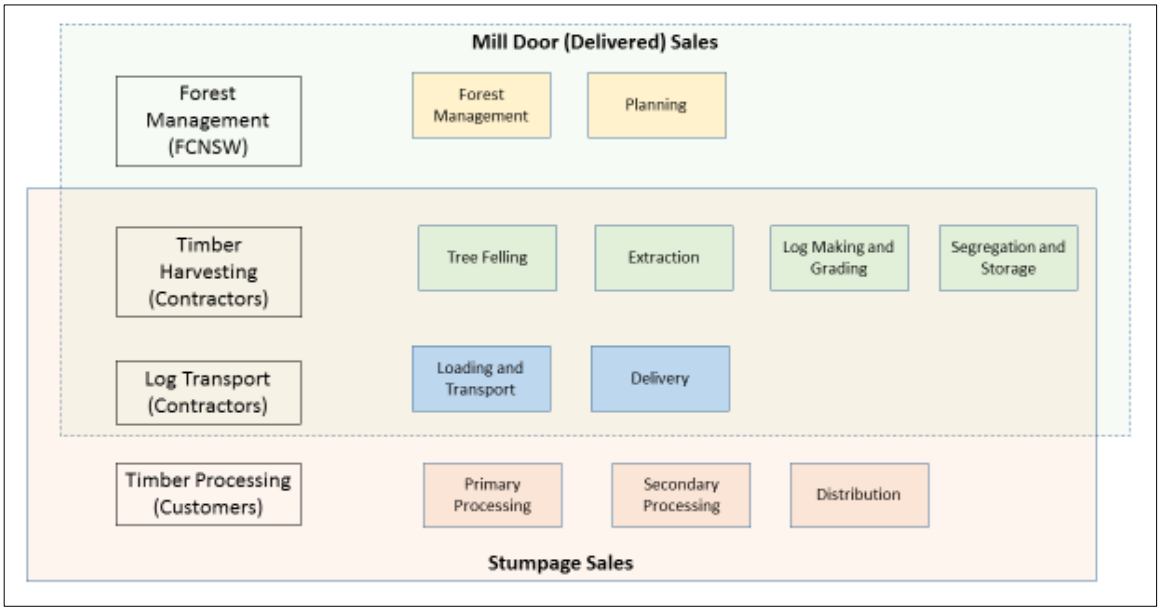
Source: FCNSW

The majority of the timber supplied by FCNSW, and of revenue to FCNSW, from native forest is sold on a 'mill door' or 'delivered' basis – that is, the price customers pay for the logs includes the cost of forest management and growing as described in the form of a stumpage, plus the actual harvesting and transport costs for delivering the logs to the mill gate of the customer (termed the delivery charge) along with a FCNSW harvesting administration charge. With a mill door sale, the overall cost to the customer is termed delivered cost, incorporating the costs of stumpage, actual harvest and haulage charges, and FCNSW administration charge.

In some cases, most notably in the Eden Forest Management Area, FCNSW commercial arrangements provide for the customers to engage harvesting and haulage contractors directly, thereby purchasing logs purely on a 'stumpage' basis.

The entities involved in the supply chain and the potential commercial relationships are described in Figure 2-5. Under mill door sales, FCNSW control the supply chain to the point of delivery of the log to the customer's mill, whereas under stumpage sales, the customer assumes control of the harvesting.

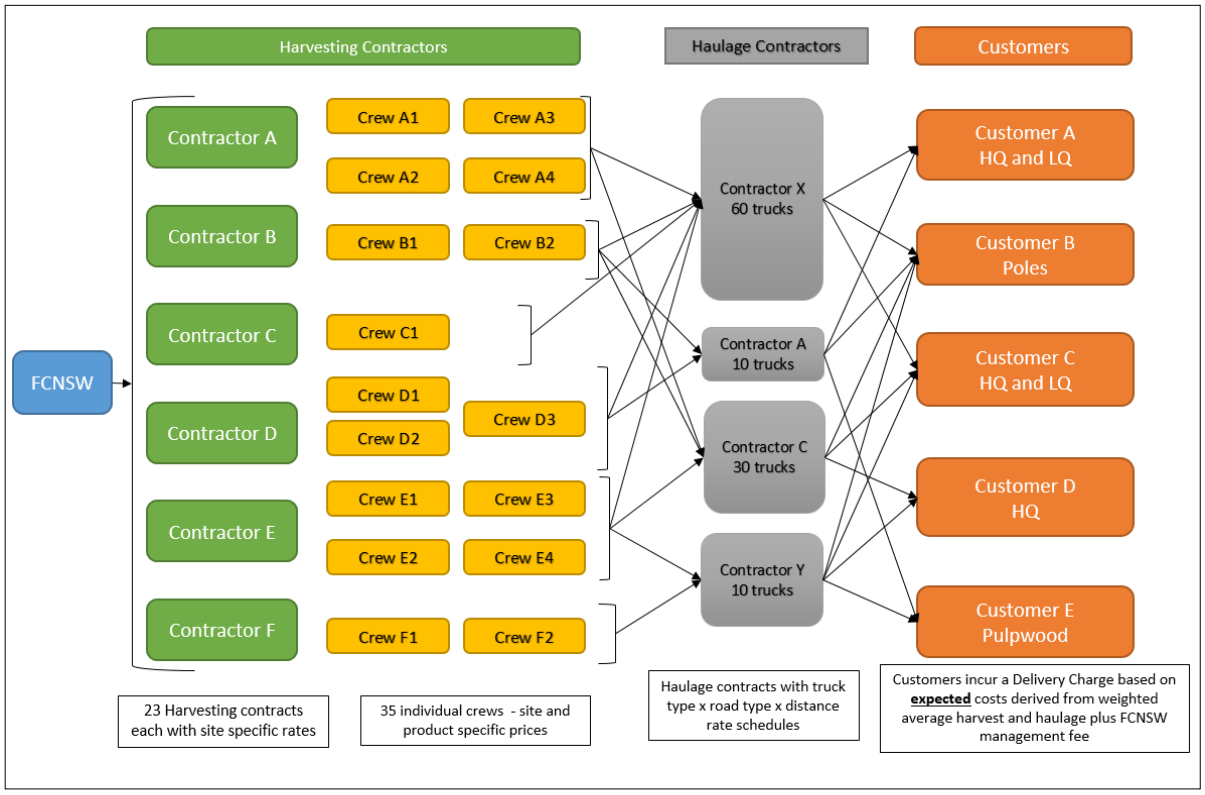
Figure 2-5: Conceptual Diagram of Alternative Sales Arrangements and Control of Supply



In the period 2013-2016, FCNSW sold logs to 159 customers on a mill door basis, 2 customers on stumpage arrangements, and 10 customers through a combination of mill door and stumpage sales.

FCNSW engaged 31 harvesting contractors and 17 haulage contractors to deliver logs during this period. The delivery charge to the customer is derived from the harvest and haul charges that are estimated from the likely combination of contract prices. Figure 2-6 provides a generalised illustration of the inputs into the delivery charge calculation.

Figure 2-6: Conceptual Log Harvesting and Delivery Model*



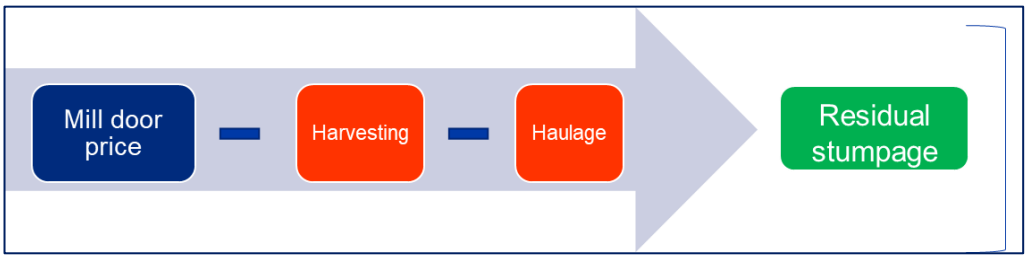
* Represents a North Coast model. The South Coast has linked harvest-haul contractors.

2.4.1 FCNSW – Log Customer Arrangements

FCNSW log sales arrangements include long term wood supply agreements, and supply contracts encompassing parcel sales on a casual and short term basis. Long term agreements have arisen from tendered or negotiated outcomes. Shorter term agreements, particularly for low quality products are also established following tenders and other forms of market exploration.

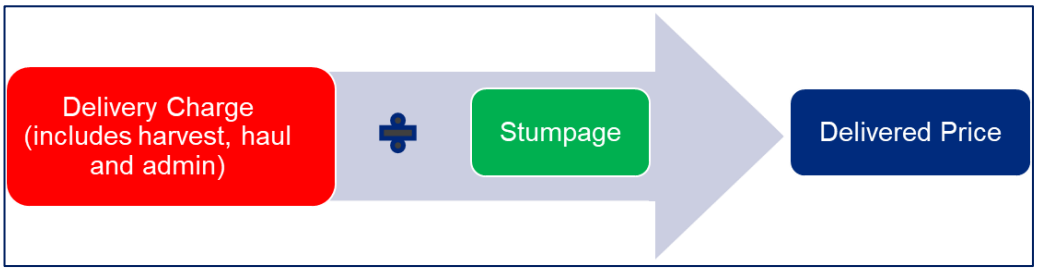
Commercial arrangements include two types of sales contracts. The first typically applies to low quality products, where FCNSW negotiate a mill door price, where stumpage movements and delivery cost adjustments are generally combined. FCNSW absorb the risk of costs either being higher or lower than anticipated, and derive a residual stumpage based on the mill door price, less contract costs as demonstrated below.

Figure 2-7: Delivered Price Contracts



The second type of contract provides for prices for the two components to be established independently – stumpages resulting from pre-defined adjustment mechanisms that include market based indices, and delivery charges that are a function of estimated contracted costs for harvesting and haulage. In this contract type, the customers wear the risk on increased or decreased costs where, for example, transport distances change from one period to the next.

Figure 2-8: Stumpage plus Delivery Charge Sale Arrangements



In both cases, contract arrangements provide for annual adjustments based on base cost movements and structural adjustments where significant changes occur such as new contracting tender processes are conducted or there are major changes to log market dynamics.

2.4.2 FCNSW – Harvest Contractor Arrangements

Given the obligations assumed by FCNSW in respect to the quantum and grade of logs to be delivered to differing customers, FCNSW engages harvesting and haulage contractors as part of the delivery arrangement. Within this delivery arrangement, FCNSW is responsible for the planning of the harvesting coupes and making these available to the harvesting contractors. FCNSW is also responsible for the overall performance of the harvesting and haulage contractors in respect to environmental as well as health and safety performance. As part of their contractual arrangements with the harvesting and haulage contractors, FCNSW requires the contractors to attain a range of minimum performance standards.

FCNSW undertakes tenders and seeks to match harvest and haulage capacity with projected demand based on the existing and proposed long and short terms wood supply agreements and industry analysis.

Typically, FCNSW enters into contracts arising from open tenders with harvesting and haulage contractors that are generally up to five years in length, and may include extension provisions. Shorter term contracts are employed to satisfy a temporary or unforeseen shortfall in capacity.

Harvest and haulage services procurement processes conducted by FCNSW that have led to the harvesting rates applicable during the study period include:

- 2006 - tender for harvest and haul for Central (North Coast), North East (North Coast), Southern (South)
- 2007 - tender for South Coast
- 2010 - external review of FNSW contract and procurement (Duggan Report) – recommendation for improved commercial basis for establishing harvest rates through active management of contractors expected revenue and productivity levels
- 2011/12 - tender for North Coast based on sample harvest units and crew day rates
- 2013 – 2015 - crew day rates/negotiated pricing
- 2015 - tender for Southern NSW – resulted in direct negotiation outcomes and linked harvest and haul contracts. Direct negotiation for Northern contracts
- 2016 - new harvest contracts established, return to difficulty class pricing. Consolidation of haulage contractors on North Coast to facilitate centralised despatch operation.

These agreements commonly have a number of key commercial terms:

- Contracts arising from open tenders are typically up to 5 years in duration to facilitate financing of equipment
- Shorter term agreements may be employed where there is a specific capacity shortfall or uncertainty surrounds supply requirements
- Typical annual quantities for harvesting are between 15,000 m^3 and 40,000 m^3 per annum
- Rates are usually based on a matrix that accounts for the type of product and the difficulty class related to completing the operations, or an agreed target production rate
- Contracts provide for rate adjustments that are generally based on changes in CPI and fuel.

2.5 Trends and Dynamics of the Forest Sector

2.5.1 Industry Competitiveness

The following factors largely determine the long term competitiveness of the timber industry[2]:

- Forest ecosystem health – forests must be productive and produce the highest value products possible while providing significant environmental outcomes, for the industry to utilise in order to maintain competitive advantage
- Productivity of harvesting and haulage systems - timber harvesting plays a critical role in broader industry competitiveness due its relationship between stumpage (the value of the crop), and the cost of inputs into the manufacturing sector (sawlog, pulpwood etc)
- Efficient use of the crop (value recovery) – converting standing volume into the highest possible value combination of products is essential in order to maximise stumpage to the grower and hence provide funds and incentives to reinvest into timber crops
- Effective forest management and policy – provides resource security, both in terms of volume and tenure, and providing the framework whereby the industry has a 'social licence' to operate on a sustainable basis, whilst maximising efficiencies.

2.5.2 Forces Shaping Industry Efficiency and Competitiveness

Productivity drivers in a general sense include research and development, education and training, health, safety and well-being, economies of scale, economic efficiency, labour management, social values, institutional arrangements and the legal framework within which the industry operates. Forest industry specific forces include forest access (infrastructure, topography and soils), labour availability and skills, machinery and equipment, transport systems, tree size and utilisation and skidding or extraction distances.

Timber harvesting systems employed in NSW and elsewhere in Australia reflect the regulatory, topographic, forest and market conditions within specific regions and catchments. There have been numerous forces shaping the way in which the industry operates today, including the social and political influences that have altered the nature of the resource available, the manner in which harvesting may occur, and the expectations in relation to worker and community health and well-being. The following are key overall forces influencing the efficiency of the timber harvesting supply chain.

Resource availability and structure

There has been a general decline in NSW native forest harvesting levels since the 1980's, as a consequence of land tenure changes, regulatory impositions and forest structure (see Figure 2-1).

[2] Ghebremichael, A.; Nanang, D.M. 2004. Inter-regional comparative measures of productivity in the Canadian timber harvesting industry: a multilateral index procedure. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. OR-X-391.

This has occurred nationally and within NSW. Not only has the total volume declined significantly, but the nature of the available resource has also seen a shift from harvesting predominantly older or more productive forests with larger trees, to those with a higher proportion of regrowth stands or those occupying lower productivity sites. This has all led to a general trend towards smaller logs and commonly lower yields on a per hectare basis.

In addition, this has the impact of reducing the scale of activity, as both the work site level as defined by a coupe, as well as the macro level as defined by overall harvest levels. These scale reductions impact of the effiiency of the harvesting and haulage arrangements.

Environmental regulation

Timber harvesting in NSW on crown land is regulated under the Integrated Forestry Operations Approval Framework (IFOA). This process considers proposed harvesting activities in terms of the impact on soil and water, threatened species, fisheries and cultural heritage. The current structure of the IFOA's for coastal forests contains over 2000 conditions[3]. The approvals contain the terms of a licence under the Protection of the Environment Operations Act 1997, the Threatened Species Conservation Act 1995 and the Fisheries Management Act 1994 (see Figure 2-9).

Enforcement of the licences is undertaken by the Environment Protection Authority and the Department of Primary Industry – Fisheries.

Figure 2-9: IFOA framework

Source: EPA NSW

The impact on harvesting activities is generally seen in terms of the quantity and type of trees that must be retained and protected, the manner in which tracks and trails must be drained and protected, and the resultant short duration of harvesting in any one area.

[3] http://www.epa.nsw.gov.au/resources/forestagreements/140209IFOAremakeweb.pdf

Mechanisation

Timber harvesting has increasingly seen a transition away from motor-manual tasks such as tree felling with chainsaws to mechanised operations that include:

- Tree harvesters / fellers
- Grapple skidders that efficiently move multiple tree lengths from within the forest to the landing
- Processors or loaders that debark, cross-cut and sort logs at landing.

The driver for this change was primarily efficiency through improved technology, providing better access and productivity. In addition health and safety reform has reinforced this mechanisation change.

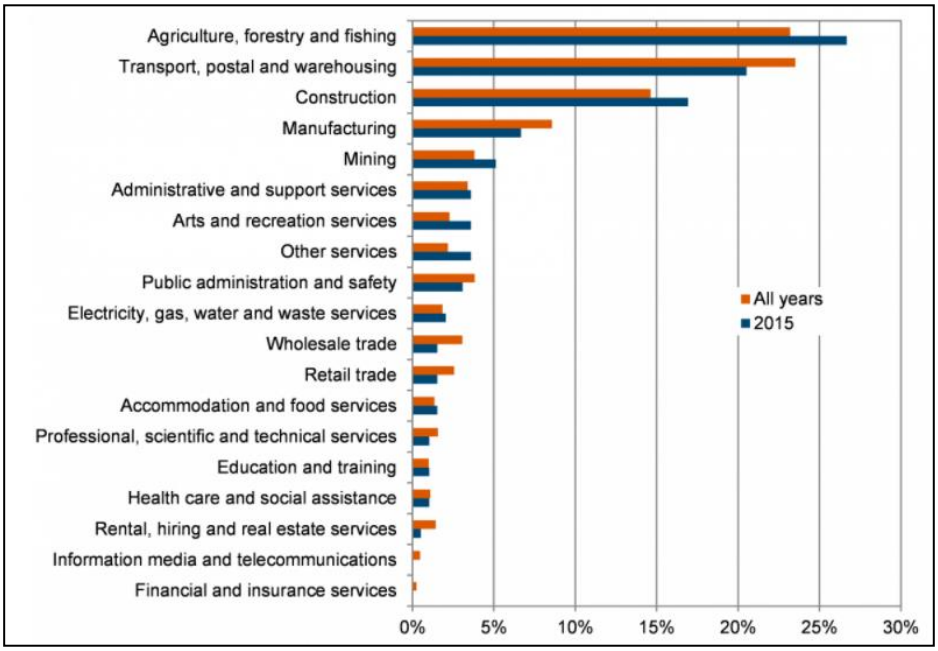
However, the consequences of this was a greater demand for capital in the form of machinery, requiring more sophisticated business structures, longer term contracts and increasing the exposure of the entities involved to fluctuating cashflow arising from changing demand, resource availability, and production capacity. This demand for capital is further noted as being for relatively highly customised machinery in respect to harvesting equipment.

Health and well-being

The timber industry has long been identified as a relatively high risk work environment (Figure 2-10), and forms part of the agriculture, forestry and fishing sector that records the highest proportion of workplace fatalities in Australia.

In the NSW context, a series of fatalities within the industry in the early 2000's was the catalyst for a significant shift in the proportion of operations away from utilising hand fallers. Positive health and well-being outcomes associated with mechanisation have also been a force in the retention of existing and recruitment of new employees in the industry.

Figure 2-10: Worker Fatalities: Proportion of all Fatalities by Industry, all Years (2003 to 2015 combined) compared with 2015



Source: Safe Work Australia / statistics

The operating environment for timber harvesting workers has been significantly changed over the last 20 years with greater mechanisation, particularly in relation to tree felling, with reductions in chainsaw operations in favour of specialised equipment such as feller bunchers. Improving safety outcomes in the workplace can come at a higher upfront cost in addition to that associated with higher capital requirements, including higher training standards, administration and management overheads, personal protective equipment (PPE) and fewer available productive work hours.

Transition to 'mill-door sales'

Over the last 20 years, forest growers have tended to manage the supply chain within the forest, rather than allocating stands to timber customers who may have contracted their own harvesting and transport, and paid the grower a stumpage fee.

The key drivers for this centred on:

- A better alignment of health and safety objectives
- More control of environmental and silviculture outcomes
- To assist with the transition to mechanised operations
- Better control of value adding / recovery operations within the forest through more sophisticated log grading procedures, market segmentation and product allocation
- Improved capacity to optimise the supply chain through making effective trade-off decisions in terms of forest infrastructure, recovered yield, harvesting costs and transport systems. Examples of this would be increasing the road network density to reduce harvesting costs by offering shorter snig distances from the stump to the landing.

The advantages and risks of mill door sales are discussed in detail in Section 6.5.

Markets

There has been a general decline in timber sales from native forests as is evident from Figure 2-1. Perhaps more significantly in terms of impacting on operating costs is the change year on year in demand for specific products and overall fibre. As native forests in NSW produce a range of products from high value poles and veneer logs, through to low quality sawlogs and pulpwood, any loss or decline of a particular market can significantly impact on the unit production cost of the other products. This is particularly the case where access to pulpwood markets has been unavailable or constrained. The productive capacity of harvesting crews will be curtailed if only a small proportion of each tree, or trees within a stand contain merchantable material.

Corporate behaviour

Across Australia, native forest harvesting is now dominated by the supply arising from public native forests. This results in both the harvesting and haulage contractors, and processing customers having a high dependency on this supply for their businesses. Similarly, across Australia, most public native forest management agencies while being government entities have had an increasing focus and scrutiny on their commercial arrangements.

Most Australian public native forest management agencies are now in a corporatised form, resulting in increased transparency in their reporting arrangements, governance functions and financial performance. This trend was largely initiated in the mid-1990's and then became increasingly commonplace through the 2000s. This reflected public policy frameworks, given the functions of the management agencies included them being an arm of government with an overtly commercial interaction. In some circumstances, this resulted in the commercial arm being fully separated from the arms of government involved in the stewardship and protection activities of public land management (i.e as observed in Victoria and Western Australia) or where a corporate entity is formed with clear governance and financial frameworks but retaining the stewardship and commercial activities within the one organisation (i.e. NSW and Tasmania).

This corporate platform of clear commercial performance has resulted in the forest management agencies looking to establish both log pricing arrangements reflective of the capacity to pay in the market place, as well as efficient cost management so as to enhance the resource rent and capture of this rent to the owners of the resource, which is the representative of the respective State Government. Within this arrangement, the forest management agencies assess the potential risks and uncertainty to their financing, and seek to manage this as effectively as is reasonable given their governance arrangements and overall mandate.

An upshot of this increasing corporatisation of the behaviour of the forest management agencies is that the agencies dealings in the marketplace sought to reflect commercial arrangements as would be expected by private parties. This level of reflectance is influenced by the legacy arrangements and operating environment (i.e. planning or regulatory frameworks) in which the forest management agencies operate, as well as the mandates provided to them by their shareholders.

3. BENCHMARKING ANALYSIS

This Section discusses the approaches to the collection and analysis of data from FCNSW and comparator organisations, in order to provide a meaningful insight into costs within the industry during the period 2013 – 2016.

3.1 Background

The benchmarking analysis has been undertaken in two parts:

- unit cost comparison for the period 2013 – 2016; and
- analysis of cost drivers through the development of productivity cost models.

The intent of the unit cost comparison is to provide key benchmarks for comparison with other jurisdictions, to establish a base for future analysis, and identify the set of costs and associated parameters that will enable a detailed comparative analysis, whilst accounting for key cost drivers and influences.

Unit cost benchmarking is useful to the extent that operating conditions are significantly comparable, or cost drivers are relatively simple and transparent. Harvesting timber in Australian native forests is relatively complex for several reasons including the;

- heterogeneous timber resource and silvicultural requirements
- different landforms and ground conditions
- variable markets
- contrasting regulatory environments.

This results in a relatively high degree of customisation of the product and related service provision, particularly with respect to harvesting arrangements. This customisation across forest harvesting arrangements can be observed through the machinery capital being deployed, the specific requirements of the human capital skills and the work methods being applied. The degree of customisation can be commonly sourced to on-going exploration of methods utilised by the forest managers and the contractors involved in the harvesting and haulage services, and as a response for on-going cost pressures and desires to enhance operational efficiency.

In order to effectively compare the unit costs within each operating environment, the customisation relating to enterprise configuration, equipment and labour has been analysed through the construction of productivity cost models relating to harvesting and haulage operations. The intent of these models was to identify the cost factors contributing to overall costs for each jurisdiction, and thus enable a reasonable comparison across differing environments. As will be discussed later, data limitations constrained the use of the models as a means of comparison.

Alternative approaches to benchmarking include the use of productivity indices and stochastic frontier analysis. Data requirements to support such approaches can be significant. These issues are explored in Section 4.

3.2 Procurement Processes for FCNSW and others

FCNSW have undertaken the following procurement processes since 2006. This period is considered relevant to the study period as the prices paid for services from 2013 – 2016 resulted from both older contracts won via tender, contracts rolled over or negotiated, or new contracts awarded during the study period.

Prices paid during the study period were a combination of open tender results and direct negotiations arising from the processes described below:

Year	Action
2006	Tender for harvest and haulage services for Central (North Coast), North East (North Coast), Southern (South)
2007	Tender for South Coast
2010	External review of FNSW contract and procurement (Duggan Report)
2011/12	Tender for North Coast - crew day rates/negotiated pricing
2015	Tender for Southern NSW (this led to direct negotiations and a move to linked harvest-haul contracts), direct negotiation for Northern contracts, return to difficulty class pricing
2016	Consolidation of haulage contract on North Coast – North-Haul

Source: FCNSW

As a comparison, the West Australian Forest Products Commission (FPC) advised that they conduct open tenders for the majority of the harvest and haul services required, with terms of up to 9 years, aligned with Forest Management Plan (FMP) periods.

In Tasmania, the industry was substantially restructured in 2010/11, resulting in over 50% of the contracting capacity exiting, with an undertaking to not re-enter the industry for at least 5 years. As a result, Tasmanian prices have largely been derived from direct negotiations with the remaining parties.

3.3 Unit Cost Comparison

A unit cost comparison of both contract rate schedules and actual unit costs was used to assess the rates used by FCNSW. Rate schedules have been sourced from current contracts and periodic

rate reviews. Unit costs have been collated from FCNSW sales and contractor databases for the relevant period, and where available from comparator operations FPC and Forestry Tasmania (FT).

Production data for NSW is reported by region (north for north coast, south for south coast (excluding Eden) and the data is presented for the three relevant years.

In this report, the following terms are used;

- *Unit costs* – the unit cost is derived by dividing the total expenditure by the number of tonnes of product produced. This has been reported for total quantity of all products, as well as by individual product and contractor groups.
- *Unit rates* – the unit rates are those specified in individual contracts. Where unit cost data is not available, average rates have been calculated either on a straight or weighted volume basis.

Where possible, unit costs have been used for comparison purposes as this measure accounts for different margins applied to difficulty classes, products and other variables. It is also an actual measure of costs across the operation of interest. As an example, Table 3-4 demonstrates the margins applied to each product in FCNSW contracts in order to both reflect the additional costs associated with producing high quality logs, but also to offer the contractor an incentive to maximise the production of high value products. Thus, the average cost will vary depending upon the proportion of each product produces from any one operation.

Commonly, FCNSW contracts has annual indexation measure that uses CPI and fuel as the key indicators. The changes in these indexes over the relevant period are presented below. Figure 3-1 shows the difference in diesel prices by Australian city.

Table 3-1: CPI 2013 – 2016

Period	Index	Annual Change
Jun-2014	106.0	2.79%
Jun-2015	108.3	2.15%
Jun-2016	109.3	0.92%
Total		***5.86%***
Average		***1.95%***

Source: ABS. Note - Sydney (all groups)

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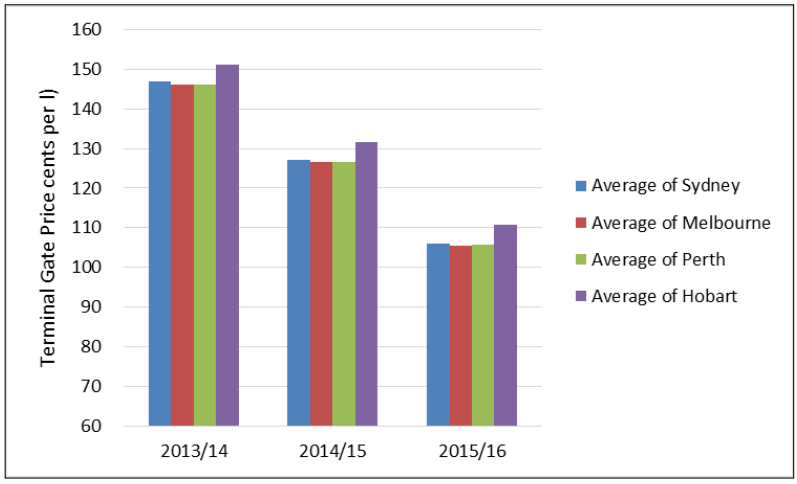
Table 3-2: Average Diesel Terminal Gate Price (Sydney)

Period	Index	Annual Change
Jun-2014	143.31	2.68%
Jun-2015	127.08	-15.48%
Jun-2016	106.00	-14.13%
Total		***-26.93%***
Average		***-8.98%***

Source: AIP - http://www.aip.com.au/pricing/tgp/

Figure 3-1: Average Terminal Gate Price for Diesel 2013 – 2016



Source: AIP - http://www.aip.com.au/pricing/tgp/

3.3.1 Unit Costs – Harvesting

3 year trend within FCNSW

Harvesting costs for all products were derived for each of the three relevant years and are shown for the two major regions North and South. Over the three year period, harvesting costs on average were maintained below the Consumer Price Index (All Groups – Sydney) as is evident from Table 3-3.

Table 3-3: Rate of Change – FCNSW Harvesting Unit Costs

Harvest ($ per gmt)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	37.54	38.66	39.54	2.01
Annual Change		*3.0%*	*2.3%*	
Total Change				*5.3%*
Production South	27.65	30.43	30.15	2.50
Annual Change		*10.1%*	*-0.9%*	
Total Change				*9.1%*
Total	36.80	37.41	37.33	0.53
Annual Change		***1.6%***	***-0.2%***	***0.7%***
Total Change				***1.4%***

Source: FCNSW

Note the 2013/14 harvested volume in Production South represented 7% of the total volume, and 24% in 2015/16. Therefore, the weighted total average rate of change over the 3 year period is less than the rate of change for the regions.

Within the review period, the indicator price of fuel (see Table 3-2) declined by an average of 8.98% per annum. FCNSW have indicated that fuel accounts for between 11% and 15% of harvest costs in terms of annual indexing mechanisms within harvest contracts.

As stated above, in order to provide an incentive for harvesting contractors to produce high value products, and to provide some recognition of added production costs, FCNSW apply the following product pricing differentials in each of the regional production zones tabled below.

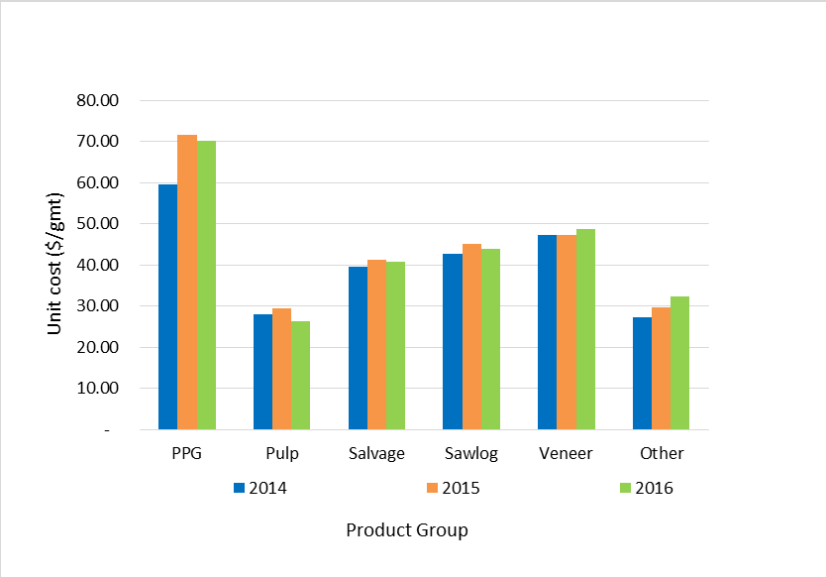
Table 3-4: Pricing Differential Applied to Base Rates

Product	North	South
Poles and Piles	150 - 200%	175%
Girders and Veneer	150%	150%
High Quality Sawlogs	100%	100%
Low Quality / Salvage Sawlogs	80 - 85%	85%
Pulpwood	65%	70%
Firewood / Other Pulp/Residue	65%	70%

Source: FCNSW

This has the impact of the harvest rate distribution across the different product types as demonstrated in Figure 3-2. Note, these costs are also impacted by localised harvesting conditions, including the mix of products, such that small volume lines such as PPG (piles, poles and girders) will vary from year to year more significantly than primary products such as HQ sawlog and pulp.

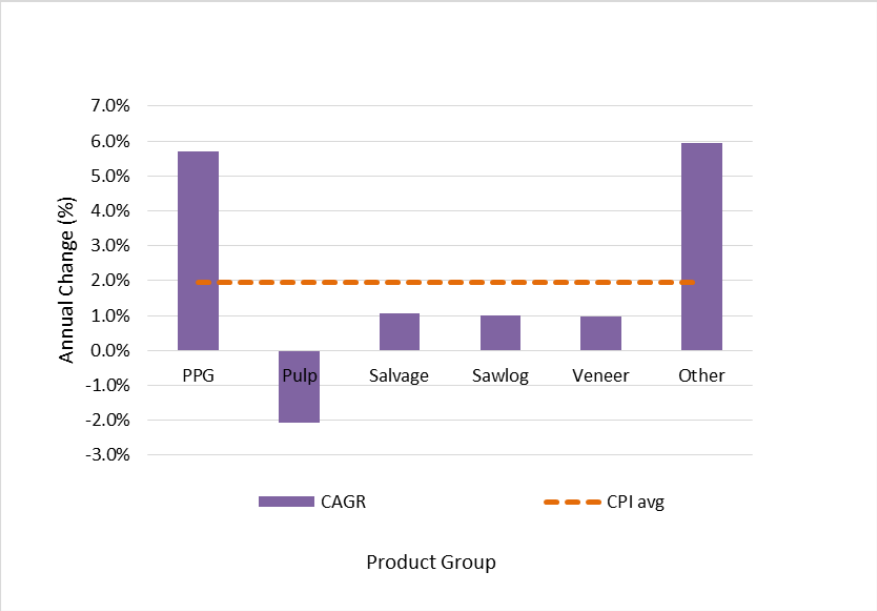
Figure 3-2: Average Cost by Product 2014 - 2016



Source: FCNSW

Assessing the change in unit costs by FCNSW product group over 2014-2016 indicates significant variation between the products (Figure 3-3). This indicates the % increase in rates has been higher for the PPG group, while the major products such as sawlog have increased at a rate lower than CPI.

Figure 3-3: Compound Annual Growth Rate by Product Relative to CPI 2014-2016



Source: FCNSW, ABS

Comparison with other jurisdictions

A direct comparison of average harvest rates between native forest operations across Australia is of partial benefit as described in Section 3.5.1. This arises due to the variation in operating conditions and hence factors that affect productivity are significant.

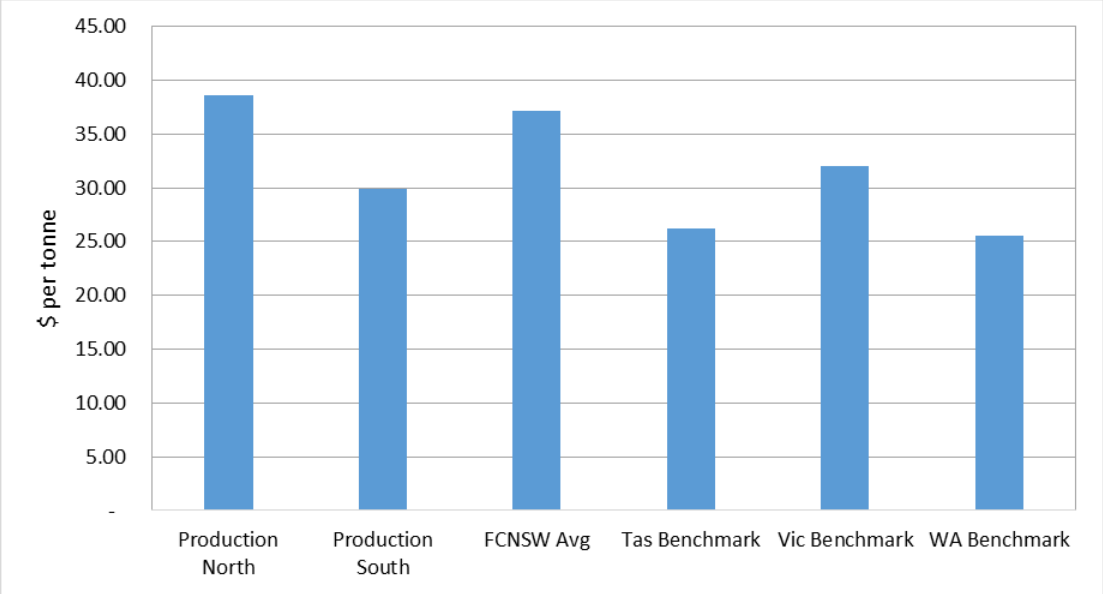
However, a comparison of the four jurisdictions harvest rates across all operations is provided in Figure 3-4. Note that rates reflect the following:

- FCNSW rates are average unit costs (average rate paid) in 2015/16
- Tasmanian rates are an average price weighted across all harvesting contracts
- Victorian rates are an estimate from a publicly available cost model with sample localised parameters entered as a base.

WA rates are average unit costs (average rate paid) in 2015/16.

The range is from $25.53 to $39.54 per tonne. The underlying drivers for much of this range are described in Section 3.5.1.

Figure 3-4: Harvesting Unit Cost and Rate Comparison FCNSW, Tasmania, Victoria and WA*



Source: FCSW, FT, FPC, FIC[4]

*Note – as described above, a comparison of average unit rates is of partial benefit as there is no accounting for different operating conditions, markets and contract structures.

3.3.2 Unit Costs – Haulage

3 year trend within FCNSW

Over the three year period, average haulage unit cost increases exceeded CPI across both regions, with an average growth rate of 3.6%, where haulage cost is the weighted average cost for all products delivered in the three year period (Table 3-5).

[4] Forestry Industry Council (Vic) — Rates and Costs Schedule 2015

Table 3-5: Rate of Change – FCNSW Haulage Unit Costs (per gmt)

Haulage ($ per gmt)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	21.99	23.31	23.27	1.28
Annual Change		*6.0%*	*-0.2%*	
Total Change				*5.8%*
Production South	32.39	29.47	28.19 -	4.21
Annual Change		*-9.0%*	*-4.4%*	
Total Change				*-13.4%*
Total	22.76	24.25	24.43	1.67
Annual Change		***6.5%***	***0.8%***	**3.6%**
Total Change				***7.3%***

Source: FCNSW, ABS

However, when units are converted to $ per tonne km (tkm), for the purposes of removing distance as a variable, the average total rate increase across both regions is 0.4%, which was well below CPI for the same period (Table 3-6). Within the review period, the indicator price of fuel (see Table 3-2) declined by an average of 8.98% per annum. FCNSW have indicated that fuel accounts for between 25% and 30% of haulage costs in terms of annual indexing mechanisms within haulage contracts.

Table 3-6: Rate of Change – FCNSW Haulage Unit Costs (per tkm)

Haulage ($ / tkm)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	0.1994	0.2063	0.2006	0.0011
Annual Change		*3.4%*	*-2.8%*	
Total Change				*0.7%*
Production South	*0.1435*	*0.1620*	*0.1739*	*0.0304*
Annual Change		*12.9%*	*7.3%*	
Total Change				*20.2%*
Total	0.1937	0.1976	0.1944	0.0007
Annual Change		***2.0%***	***-1.6%***	***0.2%***
Total Change				***0.4%***

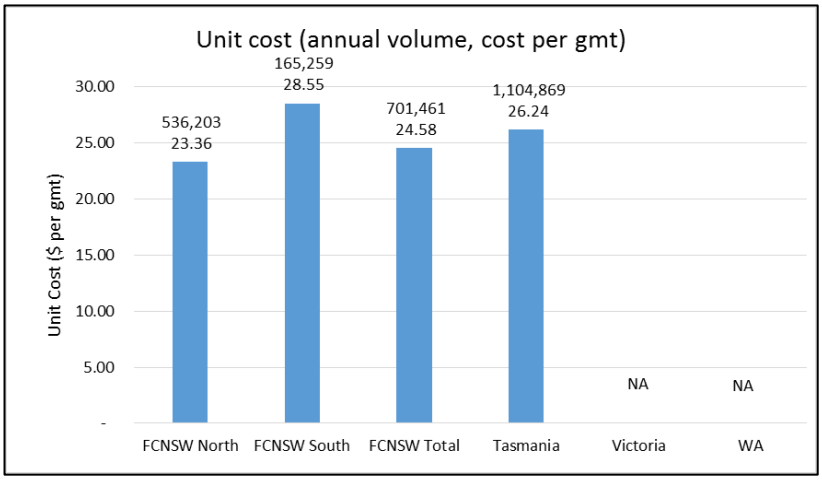
Source: FCNSW, ABS

Basic cost drivers including transport distances will have a masking effect on other underlying factors, such that average costs per tonne provide limited insight into market rates, however per tonne costs do reflect the impact on total delivered cost to the customer. These factors are further considered in Section 3.5.1.

Comparison with other jurisdictions

Whilst operating conditions for haulage costs are more comparable across jurisdictions compared to harvesting costs, a simple comparison of transport unit costs with other forest owners needs to be carefully considered and requires an understanding of market rates as operating parameters can be significantly different. This includes differing average haul distance. Unit costs for each forest owner are demonstrated in Figure 3-5.

Figure 3-5: Haulage Unit Cost Comparison (2015/16)



Source: FCNSW, FT. Note – simple unit cost comparison is of limited benefit due to differences in average distance, road conditions and truck configuration.

A comparison of unit rates varies depending upon the distance at which the price is quoted. To allow a comparison of haulage costs, a $ per tkm rate has been established at 100 kilometres (km), a distance which is an approximation of the average lead for FCNSW operations compared to other jurisdictions. This indicates the average rate for a 100 km haul in NSW is higher than paid in Tasmania and lower than that incurred in WA. The following table summarises this comparison.

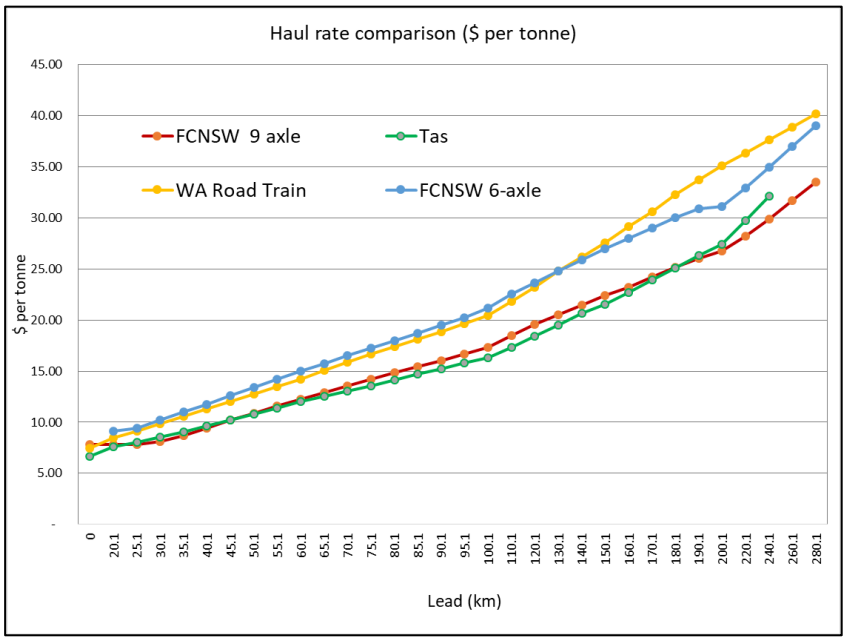
Table 3-7: Haulage Rates $ per tkm at 100km – 110km band

Entity	Haulage ($ / tkm)
FCNSW average rate all trucks	0.1995
Tas average rate all trucks	0.1633
WA average rate all trucks	0.2199

Source: FCNSW, FT, FPC

A comparison of rate schedules is provided below (Figure 3-6). This suggests the FCNSW rates fall within the range for the comparator jurisdictions.

Figure 3-6: Comparison of Average Haulage Rate Schedules



Source: FCNSW, FT, FPC

3.3.3 Customer Delivery Charges

As discussed in Section 2.4, FCNSW sell logs on a stumpage or mill door basis. For the majority of mill door sales contracts, a stumpage component of the total price is included to recognise the cost of growing the timber, and a delivery charge applies to cover the cost of harvesting and transporting the logs. The delivery charge comprises estimated contracted harvesting and haulage costs, and an administration charge.

Delivery charges are discussed in more detail in Section 6. The 3-year trend is provided below. Across all operations, the delivery charge average annual increase of 2.3% was higher than Consumer Price Index (CPI) of 1.95% (All Groups – Sydney) for the same period. Note the significant reduction in Production South can be largely attributed to the changes in transport distances on the weighted average.

Table 3-8: FCNSW Delivery Charges

Delivery Charge ($ per m3)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	69.81	72.69	74.54	4.72
Annual Change		*4.1%*	*2.5%*	
Total Change				*6.7%*
Production South	70.76	67.85	68.44	-2.33
Annual Change		*-4.1%*	*0.9%*	
Total Change				*-3.3%*
Total	69.88	71.96	73.12	3.24
Annual Change		***3.0%***	***1.6%***	**2.3%**
Total Change				***4.6%***

Source: FCNSW

Interjurisdictional data for delivery charges was not available for comparative purposes, with most agencies selling logs on a mill door price basis as described in Section 2.4.1.

3.4 Economics of Harvesting and Haulage

To facilitate meaningful benchmarking, Indufor has sought to complete an analysis that provides for an evaluation of the key cost drivers within the timber harvesting and haulage industry. We have attempted to analyse and contrast costs at three levels, being the:

- Enterprise/business level;
- Harvesting crew or truck level; and the
- Operational level.

3.4.1 Enterprise Level Cost Drivers

Whilst understanding the actual operating environment is critically important, so too is an evaluation of the other influencing factors such as the structure and profile of the businesses involved and the nature of the relationships between supplier and customer.

High level business cost drivers are tabled below. The study used this as a basis for comparing and contrasting enterprises within NSW and comparator regions.

Table 3-9: Level 1 – Enterprise Cost Drivers

Level 1 - Enterprise Level Cost Drivers		
Item	Measure	Consideration
Fixed capital (other than crew level)	$	Plant and equipment, infrastructure, business size
Working Capital	$	Business size, payment terms, cashflow
Management and supervision	$ per year	Number of staff / crews, geographic spread, complexity
Administration	$ per year	Complexity

3.4.2 Crew Level Cost Drivers – Harvesting

At a crew or truck level, costs are attributed to capital, labour, repairs and fuel. The factors that will influence unit costs are table below.

As discussed in Section 2.5, there has been a transition to mechanised operations within native forests across Australia Equipment includes specialised plant for felling, snigging and processing logs. An example of the current mandatory equipment list is attached in Appendix A. Minimum standards include specific machine guarding requirements and fire suppression systems. Financing costs will vary depending upon equipment needs, contract terms and business risk. Typical capital costs for a standard 3 machine harvesting crew are in the order of $1.2M to $2M. Data provided for this study indicates that estimates of total financing costs in the range of $0.6M - $1M per harvesting crew.

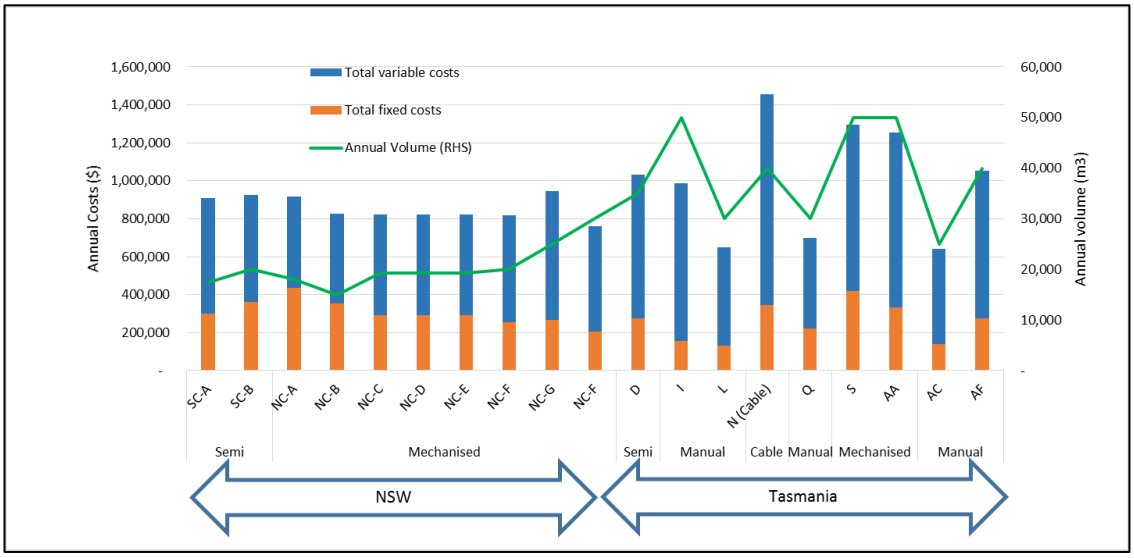
Table 3-10: Level 2 – Crew/Truck Cost Drivers

Level 2 - Crew / Truck Level Cost Drivers		
Item	Measure	Consideration
Fixed Capital	$	Machine requirements / specifications / contract terms
Labour	$ per year	Level of mechanisation / labour market
Repairs and Maintenance	$ per year	Age of equipment, servicability
Fuel	$ per year	
Work days per year	Days per year	Relocation, Wet Weather (Seasonal/ad hoc), planning delay
Work hours per day	Hours per day	Travel
Annual production	tonnes	

Figure 3-7 represents the fixed and variable cost components reported across a number of sample crews within FCSW operations and Tasmania. To the extent possible, these have been normalised against a standard harvesting crew, consisting of 3 to 5 machines with annual log production between 15,000m^3 and 50,000m^3.

Whilst the annualised costs appear to be reasonably variable across crews, whether they be mechanised, semi-mechanised and manual, what is apparent is the low annual volume throughput from FCNSW harvesting crews. This can be partly attributed to the lower number of work days available on the North Coast (210 per year budgeted per year compared to 230 elsewhere) due to wet weather and environmental compliance provisions.

Figure 3-7: Annualised Costs and Annual Volume (RHS) for Sample Contract Harvesting Crews



Source: FCNSW, FT, industry sources

3.4.3 Operational Cost Drivers – Harvesting

Site and market specific considerations heavily influence the underlying economics of felling, extraction, processing and loading. For example average daily production (m^3 per day) can vary significantly between different locations as a result of access, topography, forest condition, forest treatment (see Section 3.4.4 for discussion on silviculture) and in particular the market availability for residues such as pulpwood. The following table describes the operational factors that have the greatest impact on productivity and thereby costs.

Table 3-11: Operational Factors Influencing Harvest Costs

Function	Activities		Cost Driver	
	Primary	Secondary	Primary	Secondary
Harvesting	Falling	Travelling	Total Recoverable Volume per day	Distance (stems per ha)
		Falling and Heading		Trees per day
				TRV per tree
	Extraction	Grappling	Total Recoverable Volume per day	Utilisation level, payload / loads per day
		Travelling (loaded)		Utilisation level, distance, terrain, speed
		Travelling (unloaded)		Distance, terrain, speed
	Processing (Log Making)	Trimming		Tree size / utilisation level
		Debarking		
		Log Making Analysis		Defect level, grading complexity
		Log Making		Utilisation level, piece size, servicing requirements
		Grading / marking		Grading complexity, marking, tagging requirements
		Sorting and stacking		Sorting requirements, distance, room at dump
	Loading	Sorting	Total Volume loaded per day	Sorting reqiuirements, piece size
		Loading		

Harvesting includes the following activities:

Felling - resources required for felling trees can be a single chainsaw operator ('hand faller'), or a specialised machine. Productivity for either hand or mechanical felling is dependent upon the distance required to travel between trees to be felled, forest conditions (terrain, understorey), the complexity of felling (particularly the need to protect retained trees or drainage features from damage), and the amount of total recoverable volume (TRV) of each tree.

Extraction of logs to a roadside landing is generally undertaken in eastern native forests in Australia with skidders. These will use a winch rope or grapple to drag (or 'snig') trees from the point of felling to the landing. Productivity is directly related to log size, the average snigging distance required, and travel speed, which in turn is a function of ground conditions, terrain and slope in particular.

Processing - most hardwood logs in Australia are required to be debarked. This is followed by 'crosscutting' to generate logs from the main stem that are appropriate size and quality to meet a particular market segment, and are suitable for transport. Processing may be undertaken by chainsaw operators or specialised equipment. Capital costs will vary accordingly. Productivity is related to the complexity of grading, and the level of defect in the trees that require servicing. All of these factors may also impact the TRV of each tree.

For felling, extraction and processing, TRV per ha is the key driver of productivity. Low yielding sites, due to either or both few commercial trees or a limited number of smaller trees, require more trees to be felled, further distances for logs to be snigged, and will tend to consist of smaller trees therefore increasing the number of pieces required to be handled by each phase.

Loading is undertaken with wheeled or tracked loaders. The time taken to load a truck is related to the average log size, and the waiting time between trucks.

The productivity of each phase or activity is also related to non-productive time. This can be significant where there are bottlenecks in the production process, such as excessive snigging distance, that constrains either the felling process by not being able to remove sufficient felled material to ensure felling can continue unimpeded, or the processing and loading process by not enabling a continuous flow of resource to the landing. Operations that maximise productivity through effective synchronisation of production phases tend to be the most efficient and cost competitive. Non-productive time resulting from wet weather, relocation, operator travel time, and machine breakdown can also have profound impacts on productivity and thereby costs.

3.4.4 Impact of Silviculture

Silviculture is the practice of establishing or regenerating forests, and managing the forest through thinning, pruning, and harvesting to meet specific objectives. In comparing harvesting rates, the silvicultural regimes employed can have a significant impact on the removed yield, and also on the costs associated with managing retained standing trees.

As is evident from the following photos, harvesting systems in NSW generally have a much higher retained number of stems that do impose a cost in terms of identifying, protecting and managing them during the harvest operation.

Plate 3-1: Single tree selection NSW

Plate 3-2: Single tree / gap selection NSW

Plate 3-3: Clearfall system Victoria

Plate 3-4: Steep clearfall Tasmania

Plate 3-5: Western Australin Jarrah harvesting – note logs are 'bark on' and of mixed quality with little segregation

Silvicultural prescriptions are developed in order to meet different objectives. This can mean maximising disturbance to provide for good regeneration from seed, or retaining mid-size trees in order to ensure growing stock is available for subsequent harvesting cycles. Of increasing relevance in NSW is the retention of trees to meet threatened species prescriptions. Some of the prescriptions relevant to the North Coast timber harvesting conditions are tabled below. The second column refers to the number of stems required to be retained per ha.

Table 3-12: Summary of Threatened Species Licence Tree Retention Requirements

Feature	Number required (/ha)	Selection requirements
Hollow-bearing Trees	**Regrowth Zone:** Up to 5 where they exist **Non Regrowth Zone:** 5 whether hollow-bearing or not **Greater Glider Trigger (>1/ha)** 8/ha in cpt.	Live tree, visible or apparent hollows in base, trunk or limbs. **Priority 1**: Active use or multiple hollows **Priority 2** : As many of: From age-cohort with largest dbh, good crown development, minimal butt damage, range of species, evenly scattered across net harvest area (NHA).
Recruitment Trees	**Regrowth Zone** One for every retained Hollow-bearing tree in the regrowth zone **Non Regrowth Zone** Minimum of 5/ha	Live, mature/late mature tree with **good potential for hollow-development and long-term survival** Select from: • From age-cohort of trees with the largest dbh, • Evenly scattered across NHA, good crown development, minimal butt damage, • Range of species. Recruitment trees may contain hollows. In stands where more than 5 hollow-bearing trees/ha occur, additional hollow-bearing trees may be retained as recruitment trees as long as they have good potential for long-term survival.
Eucalypt Feed Trees	Minimum 3/ha	Must be mature or late mature trees and they can also count as hollow bearing or recruitment trees. **Species**: White Mahogany, Swamp Mahogany, Ironbarks, Boxes, Bloodwoods, Forest Red Gum, Spotted Gum, Manna Gum, Mountain gum.
Dead standing trees	Minimum 5, if<5, all present	Stags should be retained where safe to do so.
V-notch Trees	All observed	Trees with V-notches or any other glider sap feed tree.
Koala High Use Trees	All observed	Koala sighting, trees with >20 koala scats or female + young.
Koala Feed Trees	5/ha	Primary browse species, target > 30 cm dbh trees with healthy crowns.
Glossy Black Feed Trees	All observed	Oak Trees with crushed cones.
Banksias & Grass-trees	N/A	Minimise damage to mature individuals.

Source: FCNSW, SOP 3N – Forest mark-up and tree retention

Once a tree is identified as needing protection, felling and extraction of other trees must be undertaken in such a fashion as to have no impact on the retained tree. This can add to the cost of building snig tracks, directional felling, and moving equipment.

Whilst retained tree management is common elsewhere, other jurisdictions subject to this study tend to have a higher proportion of clearfall or large gap operations, which are in essence simpler to undertake in that tree selection is more easily completed, and protection areas more easily defined and retained.

3.4.5 Truck Level Cost Drivers – Haulage

Haulage includes the following activities:

- Scheduling and despatch of trucks
- Travelling unloaded to the forest
- Loading of logs (actual loading usually performed by harvesting contractors)
- Strapping down of logs
- Transport to mill
- Unstrapping / unloading (unloading usually performed by mill).

The following factors influence the total cost and unit costs within each jurisdiction.

Equipment – prime movers and log trailers. There has been an increasing demand for specialist equipment to improve health and safety outcomes for log transport. This includes trucks with appropriate guarding, measurement scales, and GPS capability, and trailers with measurement scales, road-friendly suspension, auto-load tensioning systems, electronic braking systems and a design to meet vehicle stability requirements. An example of the current mandatory equipment list is attached in Appendix A.

The factors influencing haulage costs are listed in Table 3-13.

Table 3-13: Operational Factors influencing Haulage Costs

Level 3 - Operational Cost Drivers					
Function	Activities		Cost Driver		
	Primary	Secondary	Primary	Secondary	Non-productive time (NPT)
Haulage	Empty	Travelling empty	Volume x Distance per day	Payload	Waiting for loader
	Loading	Loading		Loaded running	Congestion at dump
		Strapping down		Total kms per day	Congestion at mill
	Loaded	Travelling loaded		Hours per day available	Driver hours - fatigue
		Unloading		Hours per day utilised (planned and unplanned NPT)	Whole load requirements (complete trips)

The key operational cost driver is the quantity transported daily. This is a function of distance, road condition, terrain, loading and unloading time, and payload. These factors are discussed below. Haulage operations, unlike harvesting, are not influenced as strongly by site specific factors, although road standard into the harvest site can vary with low yielding forest rarely justifying the expense of significant roadworks. Generally though, key drivers are more easily predicted, the operating environment more homogenous, and comparing costs across jurisdictions is somewhat easier.

The related influence on haulage costs is distance travelled from the forest to the mill or delivery site. As can be seen from Figure 3-6, there is a linear relationship between rates and distance.

The other key parameters are road standards which have an impact on travel speed as well as truck repairs and maintenance, and payload which can vary significantly ranging from standard semi-trailer configurations (27 tonnes) to road trains in excess of 80 tonnes.

A description of the different road standards within FCNSW operations is tabled in Table 3-14.

Table 3-14: Road Class Description (FCNSW)

Class	Description
A	Sealed roads where none of the conditions of Class B apply.
B	Unsealed roads: Which are formed and drained by means other than rollover drains and where none of the conditions of Class C apply. Sealed roads: Which loaded truck travel speed, fuel economy and wear and tear is assessed by Forests NSW as being no better than an equivalent unsealed B class surface due to one or more of: narrow single lane width, bitumen surface deterioration, sustained steep grade (>500m, >8 degrees) or poor horizontal alignment.
C	Unsealed roads: Which compared to Class B roads, loaded truck travel speed is reduced and truck wear and tear increased due to: - Adverse surface conditions, rollover drains, rock, rutting or corrugations. - Adverse road grades exceeding 5 degrees for more than 500 metres.

Source: FCNSW

Truck utilisation is dependent upon the non-productive time. This includes waiting to be loaded or unloaded, but can also include time where the truck is not utilised due to wet weather, or to constraints on drivers such as fatigue management restriction. Where operations are structured such that a truck may take 7 hours to complete a load from the time it leaves the depot to the time it returns, if a shorter trip is unavailable to 'fill in' the day, the truck will remain under-utilised even though it may be available for a 12 hour window for that day.

Efficiency gains can be made through effective scheduling whereby backloading or crossloading occurs (loaded running). This fundamentally means that the distance a truck is loaded exceeds the unloaded distance, so that assuming all other things are equal, the truck is spending a higher proportion of the day moving logs and generating revenue to cover both fixed and operating costs.

3.5 Unit Cost Benchmarking Analysis

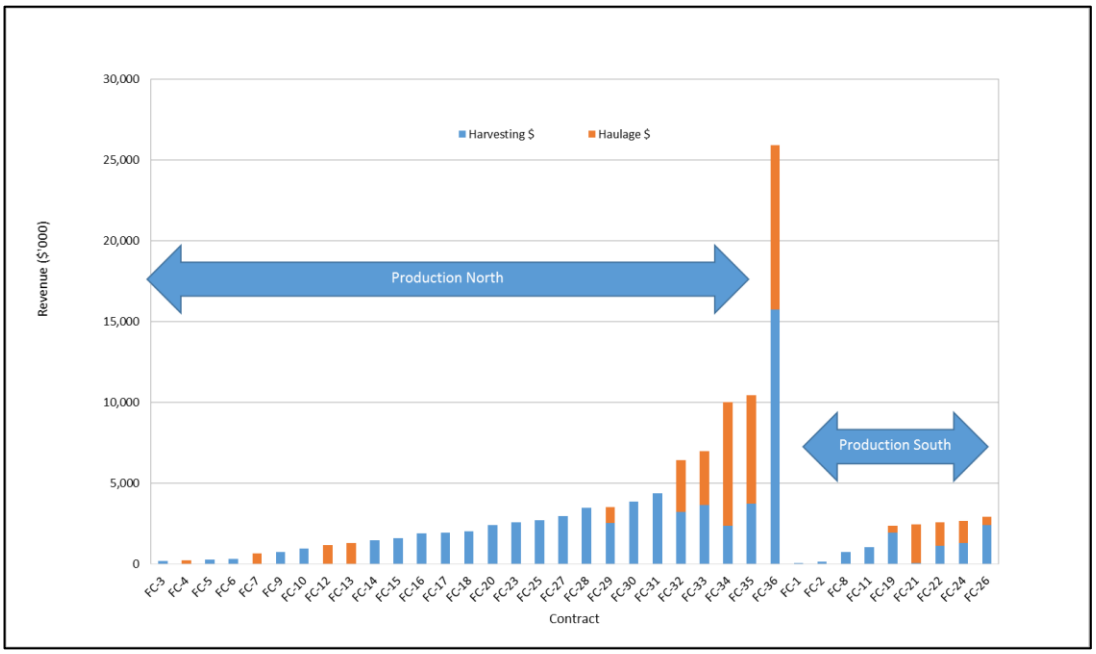
3.5.1 Cost Driver Analysis

Enterprise - Level 1

To a large extent, harvesting and log haulage companies across native forest operations in Australia are small to medium sized enterprises, commonly family based, and employing less than 20 staff. As can be seen from Figure 3-8, in the period 2013/14 – 2015/16, businesses providing harvesting and haulage services to FCNSW generally had total direct revenues less than $5M, with four having combined revenues less than $11M, with only one business generating combined revenue of close to $25M.

Whilst some entities would also provide services for operations on private forests, and for stumpage operations within FCNSW forests, this chart provides a general indication of the range of business sizes within the scope of the study. The underlying reasons for this are discussed in more detail in Section 5.2.2. Also of note is of the 36 contract entities, only 5 provide specialist haulage services, with the larger transport operators commonly also actively involved in harvesting.

Figure 3-8: FCNSW Harvest and Haul Contractor Revenue by Enterprise 2013/14 – 2015/16



Source: FCNSW

Given the business size profile, it would be reasonable to expect that operational support, management and administration costs would differ between organisations, with the larger entities offering a degree of economies of scale. Based on available data, an average of 8% of the reported annualised costs from harvesting crews in NSW was attributed to administration and management, with a range of 5.1% - 10.2%. There is insufficient data from other jurisdictions to contrast enterprises within FCNSW relative to elsewhere.

Harvesting – cost driver analysis - Level 2 Crew Level

This considers costs at the crew level without considering site specific operational factors.

A comparison of reported fixed and variable costs is provided in Table 3-15. It is 'standardised' such that the costs represent those that would apply to a single crew. A structure of a crew is described below.

Table 3-15: Annualised Costs from Sample Data for Harvesting Crews (FCNSW, FT)

Crew Type	Typical machine configuration	Typical labour requirement	Reported annualised costs – average and range ($'000)	
			Fixed costs	Operating costs
Manual (Tas only)	skidder, excavator, dozer	3 man crew – hand faller, skidder operator, dumpman	185 (130 - 274)	620 (464 – 829)
Semi mechanised	skidder, 2 x excavator (harvester and loader), dozer	3 man crew – hand faller, skidder operator, dumpman	311 (274 – 360)	646 (567 – 760)
Mechanised	feller buncher, skidder, harvester, excavator (loader)	4 man crew – machine operators	305 (205 - 435)	633 (474 – 922)
Cable	harvester, yarder, 2 x excavator	7 man crew – hand faller, chokerman, plus machine operators	345	1109

Source: FCNSW, Forestry Tasmania

This analysis provides an indication of the higher fixed costs associated with capital requirements for mechanised crews. The degree to which crews are mechanised will be dependent upon the market in which they operate. Longer term contracts that offer greater certainty will facilitate capital investment. Contract terms vary across the jurisdictions, with NSW typically 3 to 5 years, Tasmania 1 to 3 years, and WA up to 9 years.

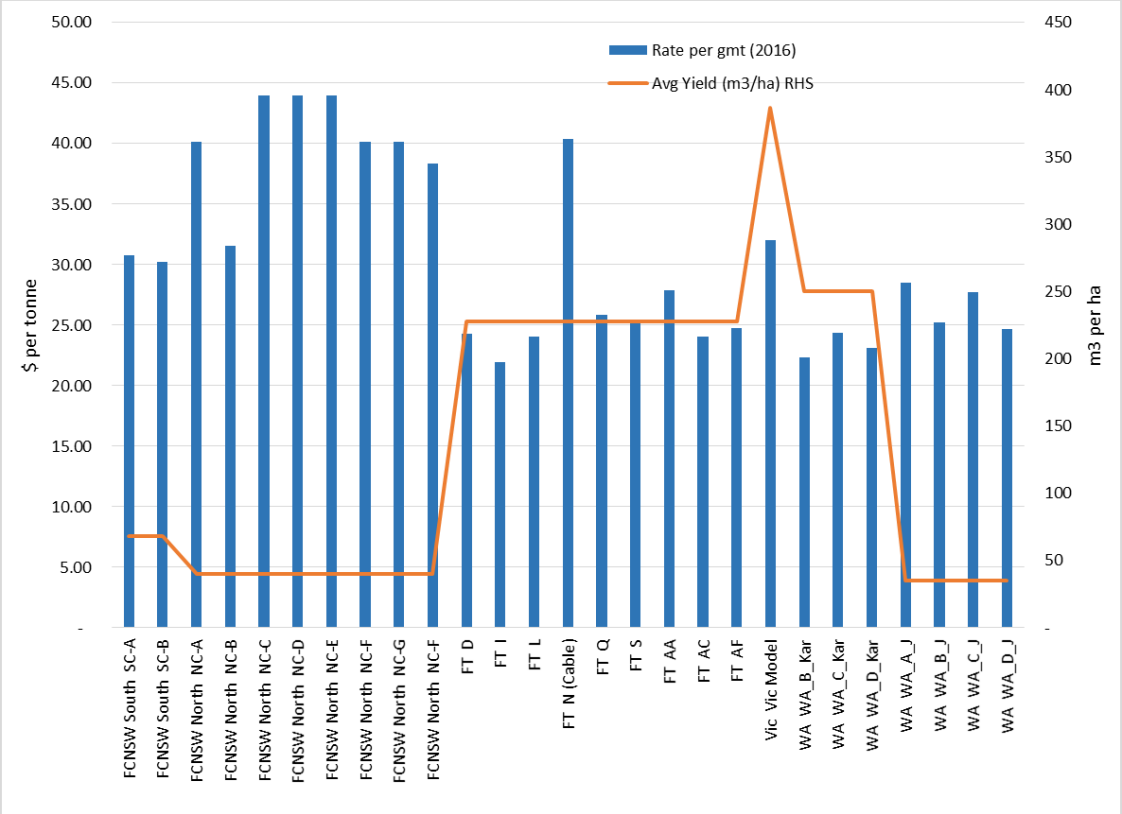
It could be expected that a higher level of mechanisation would offer higher productivity, expressed as daily or annual production. However, from the data provided, it is apparent that the impact of other drivers play a much more significant role in productivity than the structure of the crew. This is demonstrated by the fact that manual crews in high yielding forests are more productive on an annual basis than mechanised crews in low yielding areas.

Harvesting – cost driver analysis - Level 3 Operational

At the operational level, individual factors that impact on the productivity (and hence unit cost) of each phase of the operation are considered. Table 3-16 provides a summary of the comparison in these factors between the jurisdictions.

Yield per ha is a primary cost driver as is evident from Figure 3-9. The exception is WA where ground conditions are relatively flat, and log processing in many cases is limited to producing a 'bole' log only and without the need to debark the log.

Figure 3-9: Harvesting Unit costs Comparisons relative to Inferred Yield per Ha



Source: FCNSW, FT, FPC, industry sources

Figure 3-10 further details a comparison of WA and FCNSW harvest rates, with yield per ha as a key variable. This suggests that within the 20-50 tonne/ha class, FCNSW rates are 15% to 44% higher than WA thinning and clearfalling rates. If one assumes that the NSW operations more closely resemble thinning operations given the retained stem requirements, the NSW rates are comparable given that the WA rates include whole bole harvesting without the need to debark the logs. Products requiring debarking incur an additional harvesting charge of up to 17% in WA.

The terrain of the WA operation is typically flat relative to those in the eastern states. Slope does have a significant impact on snig distance, travel speed, track drainage requirements, and general machine productivity, as described below.

On the basis of slope, harvestable yield, and silvicultural requirements, the NSW harvesting rates are comparable with those observed in WA.

Figure 3-10: Comparison of Average FCNSW and WA Harvest Rates

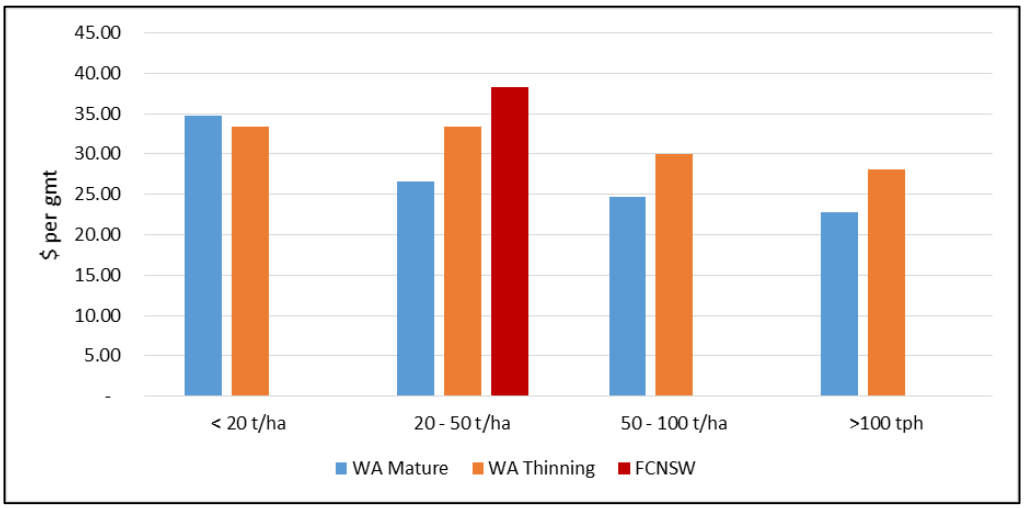


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Table 3-16: Operational Costs Factors

	Level 3 - Operational Cost Driver Analysis				
Function	**Activities**		**Cost Driver**		**Comment**
	Primary	**Secondary**	**Primary**	**Secondary**	
Road and track construction	Road construction		Distance and standard	Terrain, equipment suitability	In all cases roads are either provided by forest owner or works undertaken outside normal harvesting rate provisions. Snig tracks constructed as required. No data to support further cost analysis, but expected to have minimal impact on unit costs, although rehabilitation standards may vary across jurisdictions.
	Snig track construction		Distance and standard	Terrain, equipment suitability	
Harvesting	Felling	Travelling and tree selection	Total Recoverable Volume per hectare	Distance (stems per ha), decision complexity	Clearfall operations offer significant productivity gains over selective tree harvesting. Protection of retained stems in NSW in particular constrains tree felling efficiency. See Section 3.4.4
		Felling and heading		Trees per day	
				TRV per tree	Tree size and log size critical to harvesting productivity. See below
	Extraction	Grappling	Total Recoverable Volume per hectare	Utilisation level, payload / loads per day	Extraction productivity dependent upon tree size – log / large trees more efficiently snigged, to the point where skidder payload is exceeded. However also depends on proportion of log that is merchantable. No direct data to support utilisation level
		Travelling (loaded)		Distance, terrain, speed	Average snig distance and slope is a key to skidder productivity and key variable in establishing rates in NSW. Uphill v downhill extraction also relevant, but there is insufficient data to compare across jurisdictions
		Travelling (unloaded)		Distance, terrain, speed	As above
Harvesting	Processing (Log making)	Trimming	Total Recoverable Volume per hectare	Volume per ha / Tree size / utilisation level	Tree size and log size critical to harvesting productivity. Harvesting (including debarking, trimming) and log handling are generally linearly correlated (with log length). Therefore an increase in log diameter has an exponential (square) impact on productivity. Some data to represent FCNSW operations, however no comparative data. WA operations often only require a 'whole bole' log to be extracted, with no debarking requirement
		Debarking			

	Level 3 - Operational Cost Driver Analysis				
Function	**Activities**		**Cost Driver**		**Comment**
	Primary	**Secondary**	**Primary**	**Secondary**	
		Log making analysis		Defect level, grading complexity	Simple operations (e.g. pulpwood only), or high quality stands with minimal defect will aid productivity through decision making, log servicing and segregation. All operations surveyed had at least 4 log grades with the exception of WA, where rate schedules differentiate between 'whole bole' operations and graded sawlogs with an average $2-93 margin (12%). No other data available to support cost analysis.
		Log making		Utilisation level, piece size, servicing requirements	
		Grading / marking		Grading complexity, marking, tagging requirements	
		Sorting and stacking		Sorting requirements, distance, room at dump	Sorting and stockpiling, in confined spaces increases costs where production bottlenecks are common, and double handling of logs is required. No data available to support cost analysis
	Loading	Sorting	Total Volume loaded per day	Sorting requirements, piece size, loader utilisation	As above
		Loading			Unit cost of loading is dependent upon the degree to which loading resources (equipment / labour) are utilised effectively. If long waiting periods between trucks, cost increase markedly. For large crews balancing equipment can be more easily achieved.

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Because of the wide range of operating conditions, the degree to which different factors interact and impact on harvesting productivity are not easily isolated and quantified. FCNSW have used differing approaches to best understand contractor cost arrangements, and in seeking to secure the most competitive price.

Difficulty Class

FCNSW have generally used ground slope and yield per hectare to classify conditions into harvesting 'difficulty classes' which are then used as a basis for suppliers to tender prices (Figure 3-11). A Difficulty Class is then assigned to each harvesting area to determine the applicable rate. This forms the current approach used by FCNSW to categorise expected contractor costs.

Figure 3-11: Example Difficulty Class Matrix from 2015 South Coast tender

Harvesting Difficulty Classes		
Coastal Zone	**Average Slope of Net Harvest Area**	
TOTAL YIELD (m3/Ha)	Less than 50% is over 15 degrees	More than 50% is above 15 degrees
40 <	1	2
20 ≤ 40	2	3
10 ≤ 20	3	
5 ≤ 10		
Harvesting Difficulty Classes		
Foothills Zone	**Average Slope of Net Harvest Area**	
TOTAL YIELD (m3/Ha)	Less than 50% is over 15 degrees	More than 50% is above 15 degrees
40 <		2
20 ≤ 40	2	3
10 ≤ 20	3	4
5 ≤ 10	4	

Source: FCNSW

Daily Production Rate Approach

After an external review of harvesting price setting systems in 2010, FCNSW developed a process to assist with establishing harvesting rates based on site specific parameters. This considered, yield and average piece size, slope and average snig distance. As a basis, 'snig tables' - longstanding industry benchmarks to estimate crew productivity - were used to estimate crew productivity, which was then further modified based on crew configurations and localised factors such as product mix. FCNSW called for tenders using Crew Day Rates as the basis of submitted prices. The agreed productivity (Daily Production Rate) was then used to calculate unit rates using tendered Crew Day Rates.

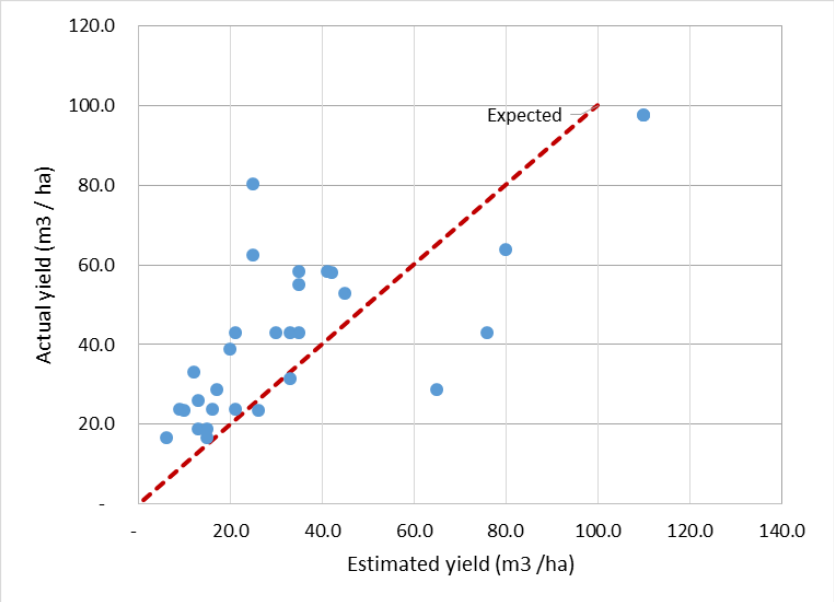
Assessment of Contractor Cost Drivers using Daily Production Rate (DPR) Estimate Data

A sample of the rates derived from the daily production rate data were provided for this study to enable further analysis of the interaction of operating factors on costs. In addition, this data

provides evidence of the uncertainty involved in estimating production from parameters that in themselves are not easily quantified. The data was limited to 105 harvest areas subject to negotiation from 2012 – 2016 from the Production North operations.

Figure 3-12 demonstrates the uncertainty in estimating yield per hectare. This compares the actual yield per ha and the estimated yield for a sample of harvesting areas during 2014 – 2016. This indicates that there may be a slight bias towards underestimating yields less than 60 m^3/ha. There are insufficient data points to conclude that higher yielding sites are overestimated.

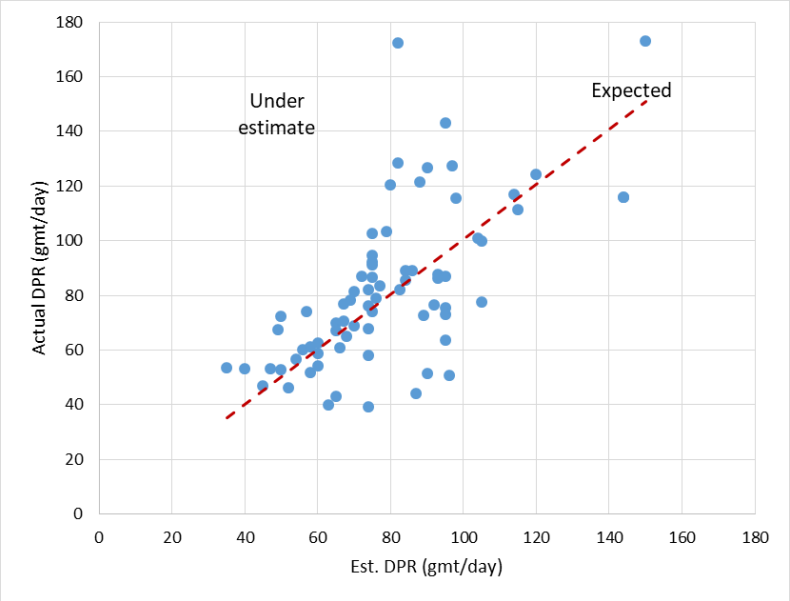
Figure 3-12: Actual Yield per ha Relative to Predicted Yield



Source: FCNSW

How these impacted estimates of daily productivity is demonstrated in Figure 3-13, where there appears to be a slight bias towards an underestimation of productivity. However, this estimate of actual daily production may overestimate the average as production data was not available for all products or crews.

Figure 3-13: Predicted Daily Production Relative to Achieved Daily Production

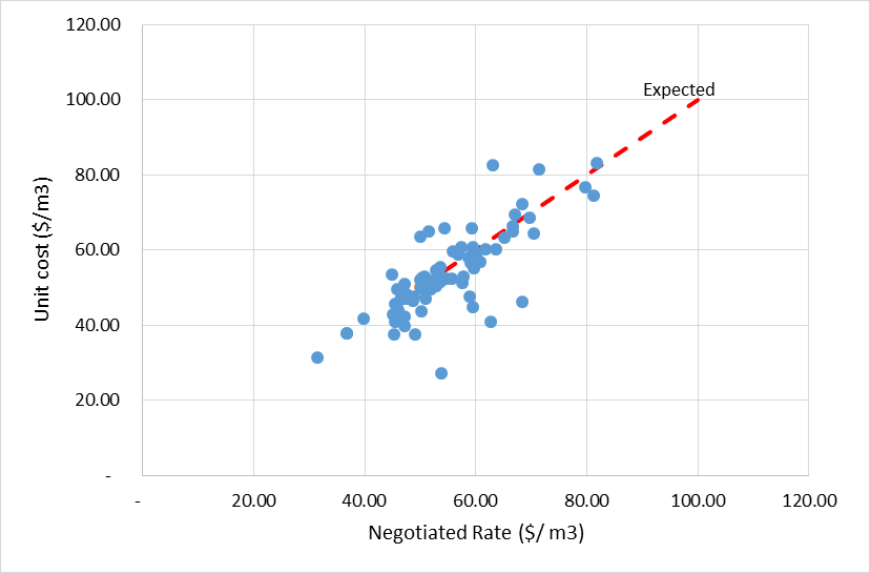


Source: FCNSW

A further level of uncertainty in establishing rates is that the product rate differentials from Table 3-4 are applied, based on the product mix estimated prior to harvest commencing. The actual product mix and the estimated product mix may vary significantly from site to site, such that the actual unit cost may not reflect the negotiated rate.

Figure 3-14 represents the relationship between unit costs that are a function of negotiated rates for specific products, and the proportion of those products actually harvested. From the available data, on average there appears to be a reasonable relationship between negotiated rates and unit costs, albeit substantial variation on an individual harvest unit level.

Figure 3-14: Actual Unit Cost Relative to Negotiated Rate



Source: FCNSW

Linear regression analysis using Daily Production Rate (DPR) Estimate Data

An analysis of the data from the DPR process was used to investigate the relationship between actual harvest cost and snig distance, slope and total yield. These attributes are commonly considered as being the critical drivers of crew productivity and therefore production cost.

Regression results

An analysis of the core attributes was undertaken through the derivation of a multiple linear regression with the following specification:

harvest cost = snig + slope + yield per ha + constant. The results are as follows.

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Table 3-17: Regression Outcomes

Regression Statistics	
Multiple R	0.66387573
R Square	0.440730985
Adjusted R Square	0.422088684
Standard Error	8.196565827
Observations	94

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	4764.959313	1588.319771	23.64144838	2.25708E-11
Residual	90	6046.532223	67.18369136		
Total	93	10811.49154			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	35.9208	3.9514	9.0907	0.0000	28.0707	43.7709	28.0707	43.7709
EST Yield per ha	-0.1875	0.0352	-5.3183	0.0000	-0.2575	-0.1174	-0.2575	-0.1174
Avg Snig	0.0219	0.0119	1.8432	0.0686	-0.0017	0.0455	-0.0017	0.0455
Avg Slope (degs)	1.2255	0.2839	4.3170	0.0000	0.6615	1.7895	0.6615	1.7895

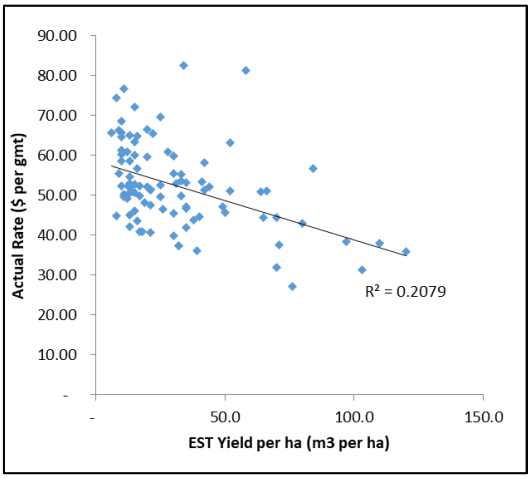
Source: FCNSW

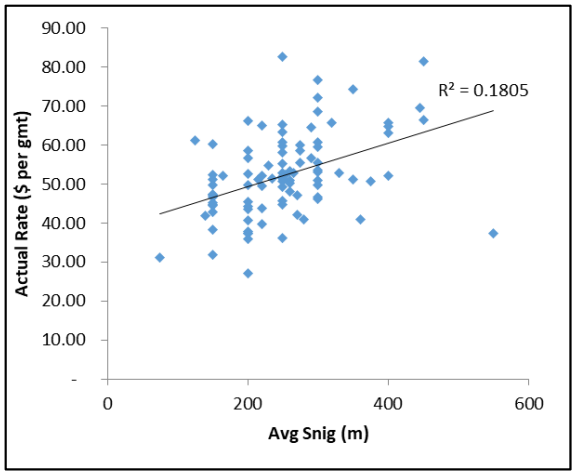
The analysis provided the following results;

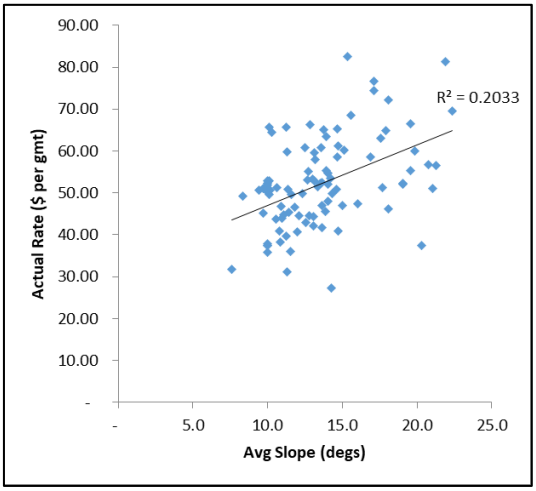
- a negative relationship exists between the harvest rate and the yield per hectare
- a loosely positive relationship exists between harvest rate and average snig distance
- a positive relationship exists between harvest rate and average slope.

The following charts demonstrate the relatively weak correlation with the spread of data points around the regression line for harvest costs (y axis) as a function of the individual cost attributes of yield per ha, snig distance and slope.

Figure 3-15: Line Fit Plots for Yield Snig Distance and Slope







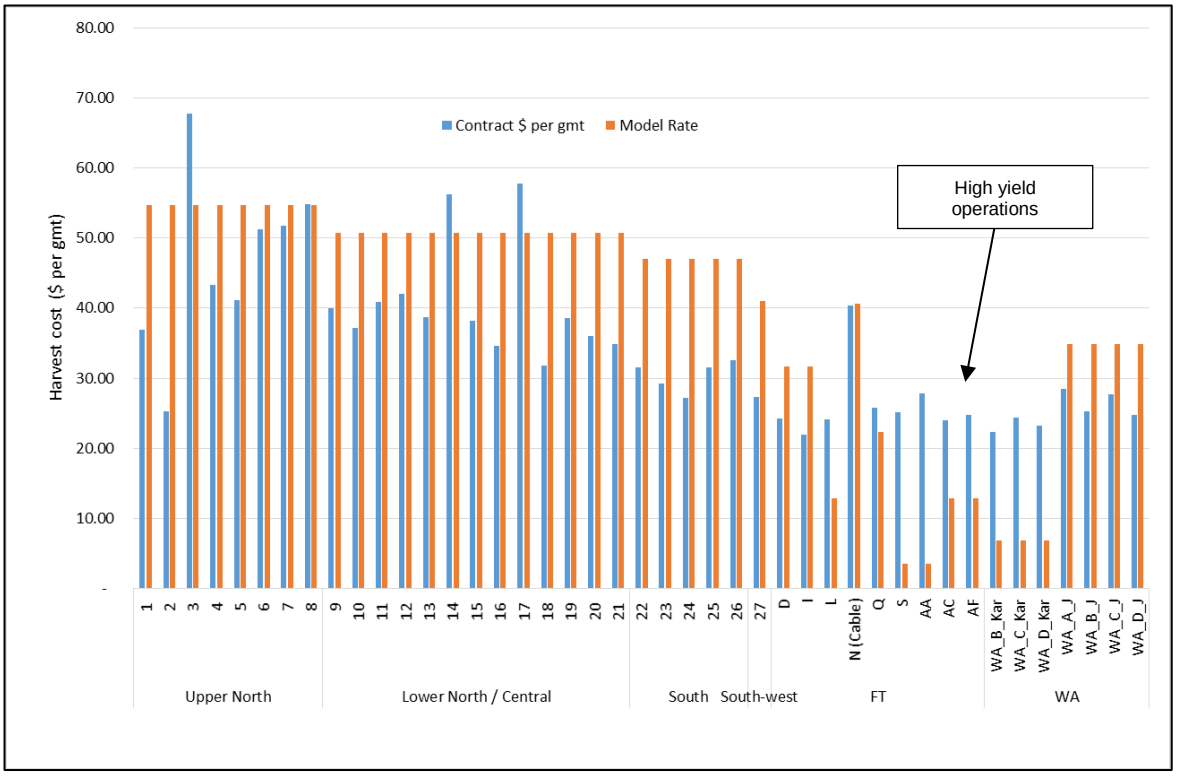
Based on the analysis, a following regression equation was derived:

Harvest Rate = 35.921 - 0.187 x (yield) +.022 x (snig distance) +1.226 x (slope)

As a test to these cost drivers contribution to harvest cost, this equation was applied to the parameters associated with the FCNSW crews average harvest rate for 2015/16, using the average yield for the upper north and lower north / central regions, and a standardised snig distance. In addition, this model was applied to the operating environment assumed to reasonably represent other jurisdictions. However, for high yielding stands in Tasmania and WA, it would appear that the

model underestimates the total cost, indicating that the relationship between yield and cost is not linear. In any case the regression has been undertaken using a population that had a maximum yield of 120m^3 per ha, and an average of 31m^3 per ha, so it is unsurprising that modelling costs for high yielding stands is not robust.

Figure 3-16: Comparison of Harvest Rate Modelled using Regression Equation and Average Actual Rate

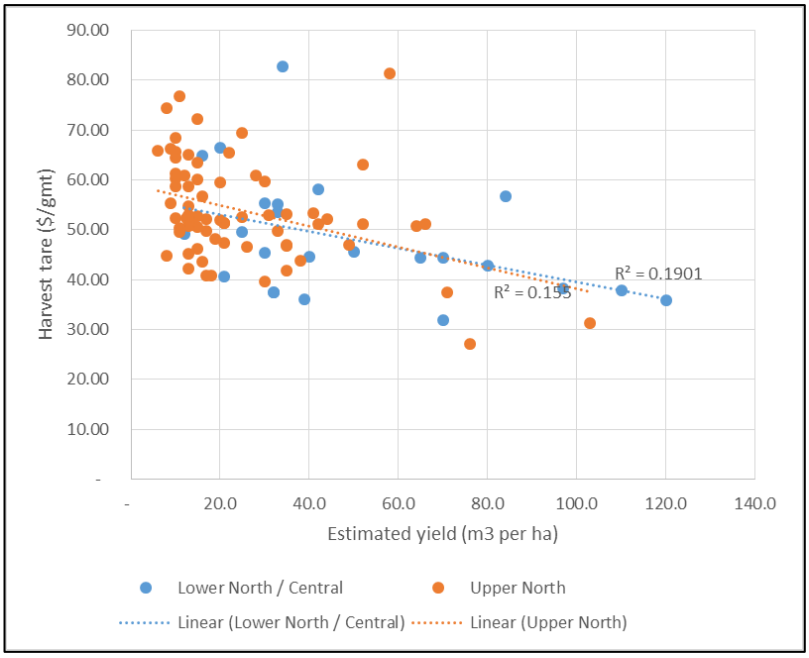


Based on these results, 42% of the variation in harvest is explained by the three variables, suggesting that the current specification of the model is a partial explanation for the harvest costs, and that there are a number of additional significant factors that contribute to harvest rate that are not accounted for in these attributes. It appears that other aspects are influencing the agreed costs of harvest. The analysis of the variability between predicted and realized yield is an example of the uncertainty. It would seem a large source of volatility is that the risk and uncertainty to the process results in significant variation in how enterprises quantify and manage this risk. Additionally, the scale elements of individual enterprises have the potential to impact on market depth and potential to derive full market competition, which reinforces the impact of high volatility in estimation of production costs.

Data limitations for this analysis include:

- Data was available only for FCNSW North Coast / Central operations for the period in which the rate setting process was followed (2012 – 2016). The following chart demonstrates the spread of yields and costs across the two areas.
- Data was available only for a sample of harvesting conditions within the region.

Figure 3-17: Harvest Cost and Estimated Yield by Area (Upper North v Lower North/Central)



Source: FCNSW

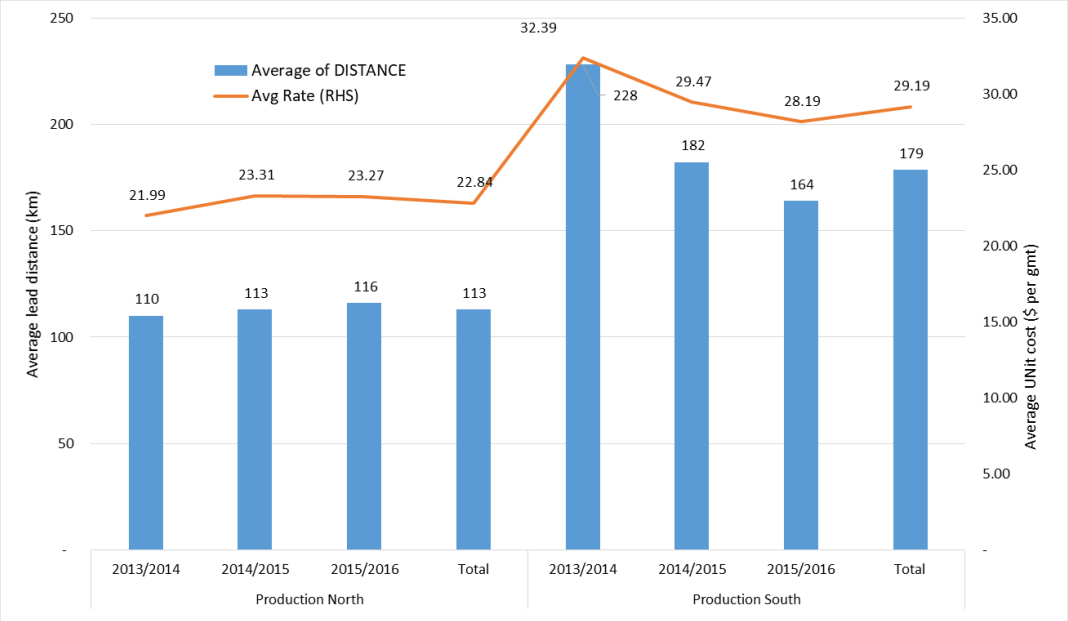
In summary, harvesting costs are related to number of factors, however the level of variation and uncertainty in predicting the variables constraints the potential to develop a definitive relationship between harvest cost and slope, yield and snig distance. From the data provided for FCNSW, Tasmanian and WA operations, and our understanding of Victorian rates, yield per hectare is the parameter that varies most significantly within FCNSW's and across comparator operations, and provides the most significant source of rate variation. It is also the most readily available measure, being a value that forest growers generally track.

Haulage – cost driver analysis

A comparison of operating conditions that impact on haulage cost drivers are summarised in Table 3-18. As discussed in Section 3.4, transport distance generally explains the bulk of unit costs variation observed in FCNSW haulage charges (Figure 3-18), however a comparison of other cost

drivers within NSW and in contrast to other operations provides some level of insight into the degree to which those costs reflect market rates and efficiency benchmarks.

Figure 3-18: Average Lead Distance and Transport Cost 2013 - 2016



Source: FCNSW

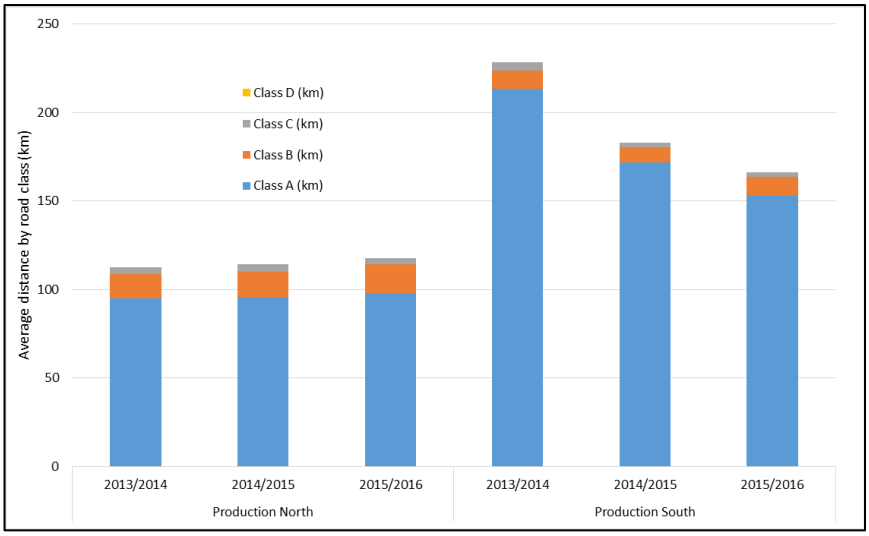
The key efficiency metrics for transport operations includes loaded kilometres as a percentage of total kilometres, and utilisation, that is, the hours a truck is used (and thereby generating revenue) as a proportion of hours available. This type of data was not available to support the performance of FCNSW operations during the study period. However, the introduction of a centralised despatch operation during 2016, has captured these statistics for the fleet under the NorthHaul contract. This indicates that truck utilisation has improved significantly from early 2016, following the introduction of the new contract. Loaded kilometres was significantly higher than industry averages. Thus, it is apparent that the log haulage fleet on the North Coast is now achieving significant efficiencies through the new operating model.

In summary, limited data is available to compare the cost drivers for operations in other jurisdictions, and for FCNSW operations prior to the introduction of the NorthHaul contract in 2016. However, it is apparent, that from various efficiency measures, there has been a significant improvement in the performance of the fleet in the Production North region as a result of the centralised despatch model. Risks associated with concentrating the market for haulage service providers will need to be managed through monitoring fleet statistics and ensuring efficiency gains flow through the supply chain.

The road standard impacts on travel speed thereby productivity and haulage costs. However limited data from other jurisdictions has not enabled a direct comparison to FCNSW charges. The NSW road classes are tabled in Table 3-14.

A comparison of transport distance by average road class for the period for FCNSW operations is demonstrated in Figure 3-19. The 'non-Class A' road distances are relatively consistent, which reflects a common approach to the original forest road network design across the FCNSW estate. The only significant variation is on Class A distances for Production South, which have resulted from changes in the customer, and therefore destination mix over time.

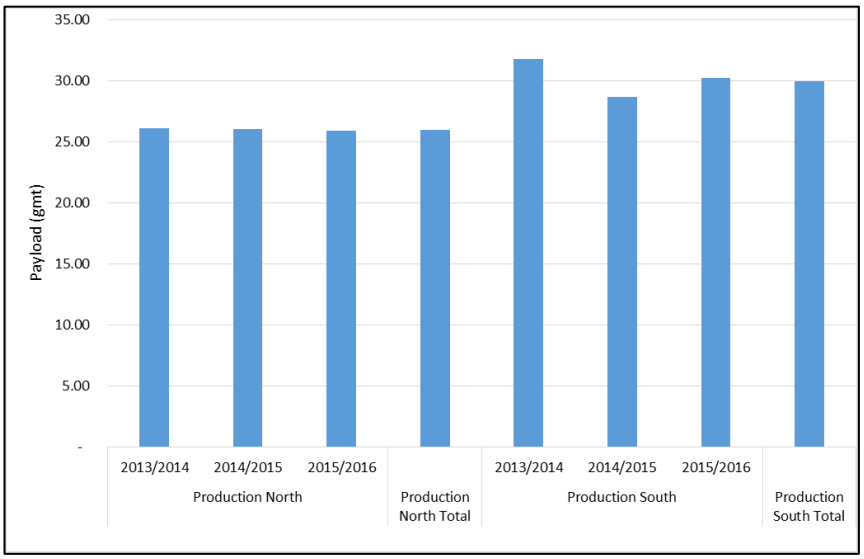
Figure 3-19: Average Transport Distance by Road Class 2013 - 2016



Source: FCNSW

The other key productivity driver for haulage operations is payload. Figure 3-20 details the average payload over the study period for the two regions. Whilst the Production North trend is flat, with an average of 26 tonnes, the Production South payload peaked in 2013/2014 as a result of 18% of sales being to customers where B-double trucks were utilised on the south-west slopes.

Figure 3-20: Average Truck Payload 2013 - 2016



Source: FCNSW

Table 3-18 provides a summary of the cost drivers introduced in Table 3-13, and the potential to compare costs across jurisdictions where data is available to do so.

Table 3-18: Haulage Cost Driver Analysis

	Level 3 - Operational Cost Drivers				
Function	**Activities**		**Cost Driver**		**Comment**
Haulage	Empty	Travelling empty	Volume x Distance per day	Payload	Most native forest operations in NSW, Vic and Tas limited to mainly single trailer (25t – 30t payload). WA employ semi and road trains (50t+). Rate schedule comparison includes truck configuration.
	Loading	Loading		Loaded running	Loading /unloading congestion can limit truck productivity. No data available to identify and compare operations.
					Industry standard 'hub and spoke' operations tend to result in 50% loaded running depending upon where depots are located. Where schedules can be coordinated to provide cross loading opportunities, significant efficiencies are gained. Appears to be improving in north coast operations as a result of centralised despatch
	Loaded	Travelling loaded		Hours per day available	Available hours is a function of legal restriction based on driver fatigue management. No data is available to compare jurisdictions.
		Unloading		Hours per day utilised (planned and unplanned NPT)	Where a combination of depot location, loading site and customer location, and in order for the driver to return home each day only part days are utilised. In addition, unplanned delays such as excessive loading times, wet weather or breakdowns result in trucks being underutilised. Exacerbated when average lead distances are in excess of 100kms. No data to compare jurisdictions.

4. ADDITIONAL ANALYTICAL APPROACHES

In addition to the industry benchmarking outlined above, the scope of this review included the consideration of the alternative techniques that could potentially be applied in the future to benchmark FCNSW's native timber harvest and haul costs.

The additional analytical techniques that we identified as potentially applicable to benchmarking FCNSW's native timber harvest and haul costs are the following:

- Productivity indexes;
- Data envelopment analysis; and
- Stochastic frontier analysis.

The following section provides an overview of the approaches for each of these benchmarking techniques. Whilst these techniques may be useful for providing robust benchmark estimates on the relative productivity of different harvest and haul businesses, these approaches are data and time intensive, and highly reliant on the accuracy of comparator data. Given this, for each of these identified techniques this section provides observations on the following:

- the feasibility of applying the technique based on the review of the benchmark information and data currently available; and
- lead times and resources likely to be required to apply this technique to benchmarking FCNSW's native timber harvest and haul costs.

4.1 Productivity Indexes

A total factor productivity (TFP) index provides a measure of output change over a period of time given the input quantity use over the same period. TFP is a relatively simple benchmarking technique that measures the weighted average of changes in output quantities relative to the weighted average of changes in all input quantities. These quantities are generally weighted by the share of each output in total revenue (in the case of competitive industries) or information on revenue and marginal cost (in the case of natural monopolies) and the share of each input in total costs.

In order to obtain an accurate measure of productivity, it is important that the data chosen accurately reflects the true use of inputs, production of outputs. For example, the use of persons employed may over or under estimate labour inputs if the number of hours worked by staff varies considerable from year to year. In such a case adjustments may need to be made to the inputs to ensure that the data accurately reflects the true effort involved.

Partial factor productivity (PFP) is a variation on TFP where only part of the bundle of inputs is examined relative to the outputs. This approach may be used in situations where there is an absence of data on a particular input or when the productivity of a particular input is of interest.

Productivity indexes have a number of advantages including:

- Simple and robust;
- Implemented when there are only a small number of observations;
- Readily reproducible;
- Requires good data discipline and consistency;
- Transparent; and
- Can be implemented when there is a lack of data on direct comparators. Indirect comparisons with other sectors of the economy can be made on a transparent basis using publicly available data.

Traditional techniques used to develop productivity indexes have a limitation in that they can only benchmark a rate of change over a period of time. A more sophisticated indexing approach using multilateral total and multilateral partial factor productivity (MTFP and MPFP) can address this constraint and give a benchmarking comparison of absolute productivity levels at a point in time.

One of the key limitations of any benchmarking using productivity indexing (TFP, PFP, MTFP and MPFP) is that these approaches are largely deterministic and do not control for exogenous factors that may have one-off impacts.

Applicability of productivity indexes to FCNSW harvest and haul costs

The feasibility of applying this approach to FCNSW will depend on the following factors:

- The availability of useful comparators, and information on other comparators (i.e. the ability to create a productivity index for other harvest and haul operators);
- The degree to which FCNSW's operations and their comparators operations are affected by large, one-off events (e.g. extreme weather, bushfire); and
- The availability of data on inputs and outputs including both price and quantity data.

Based on our industry benchmarking analysis above, our observations on the application of productivity indexes to FCNSW harvest and haul costs is that the data required to prepare productivity indexes is not currently collected on a systematic nor consistent basis in Australia.

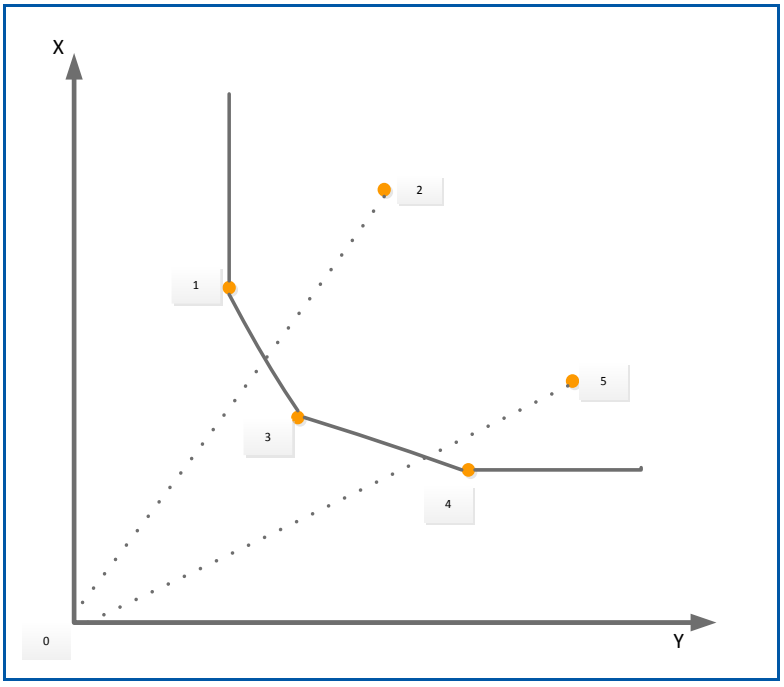
4.2 Data Envelopment Analysis

Data envelopment analysis (DEA) provides a means of calculating apparent efficiency levels across a group of organisations. The efficiency of an organisation is calculated relative to the observed best practice achieved by the most efficient organisations in the group. DEA typically adopts a linear programming based approach. The organisations considered can be whole agencies, separate entities within the agency, or disaggregated business units within the separate entities.

DEA is essential a deterministic means of constructing a 'piece-wise linear' approximation to the efficient frontier. The distribution of sample points is observed and a 'kinked' line is constructed around the outside of them — enveloping them.

The figure below provides a graphical representation of a simplified DEA analysis. The figure is based on five separate service providers whose performance have been measured and plotted against two separate efficiency measures, one on each axis of the graph. The service providers closest to the two axes are the most efficient. A kinked frontier can be drawn from service provider 1 through to service provider 3 and 4. The kinked frontier envelopes all the data points and will approximate the isoquant outlining the locus of point of minimum input use needed to produce the desired outputs — efficient production.

Figure 4-1: Graphical Representation of DEA



Source: NERA Economics

It is relatively easy to implement this simple example of DEA in a two dimensional diagram. However, with a large number of inputs and outputs and potentially more service providers it becomes necessary to use more sophisticated mathematical formulae and computer packages.

DEA is based on the identification of cost efficiency. Cost efficiency refers to the combination of technical and allocative efficiency (sometimes extended to dynamic efficiency) an organisation will only be cost efficient if it is both technically and allocatively efficient.

DEA has a number of advantages:

- No explicit functional form needs to be imposed on the data;
- It can be readily incorporated multiple inputs and outputs and to calculate technical efficiency only requires information on output and input quantities, and not prices or values;
- Possible sources of inefficiency can be determined as well as efficiency levels. It provides a means of decomposing economic inefficiency into technical and allocative inefficiency;

- It allows technical efficiency to be decomposed into scale effects, effects of unwanted inputs and a residual component; and
- By identifying the efficient peers for organisations that are less efficient it provides a potential set of role models than an organisation can look to in the first instance for ways of improving its operations. This makes DEA a potentially useful tool for benchmarking and change implementation programs. This role is strengthened by DEA's ability to incorporate differences in operating environments beyond management control and thus to make more like with like comparisons.

DEA also has a number of disadvantages including:

- Being a deterministic rather than statistical technique DEA produces results that are particularly sensitive to measurement error;
- DEA only measures efficiency relative to best practice within the particular sample;
- DEA scores are very sensitive to input and output specification and size of the sample;
- DEA gives the benefit of the doubt to organisations that do not have similar comparisons, so they are considered efficient by default; and
- Standard DEA produces efficiency “measures” which are point estimates: there is no scope for statistical inference and therefore it is not possible to construct standard errors and confidence intervals.

Applicability of data envelopment analysis to FCNSW harvest and haul costs

The feasibility of applying this approach to FCNSW will depend on the following factors:

- The availability of multiple useful comparators, and information on other comparators (i.e. having sufficient comparators in order to produce an ‘efficient frontier’); and
- The availability of highly accurate data on inputs and outputs including both price and quantity data.

Based on the benchmarking analysis undertaken for this report, it is likely that data points on price and quantity would need to be limited to other harvest and haul operators in NSW with the need to develop more granular and robust data over time to enable this analysis. Given the small number of firms involved in the NSW market, the application of DEA is likely to be of limited benefit and the difference in operating environments also constrains the applicability of DEA for cross jurisdictional benchmarking.

4.3 Stochastic Frontier Analysis

Stochastic Frontier analysis (SFA) is a regression approach to developing an efficient frontier. It accounts for outliers which are either very atypical or appear to be exceptional performers as a result of data measurement errors. SFA is a parametric technique that uses standard production

function methodology. The approach explicitly recognises that the production function represents the technically maximum feasible output level for a given level of output.

The SFA technique may be used in modelling functional relationships where you have theoretical bounds:

- Estimation of cost functions and the study of cost efficiency; and
- Estimation of revenue functions and revenue efficiency.
- Stochastic frontier models allow us to analyse technical inefficiency in the framework of production functions. Production units (firms, regions, countries, etc.) are assumed to produce according to a common technology, and reach the frontier when they produce the maximum possible output for a given set of inputs. Inefficiencies can be due to structural problems or market imperfections and other factors which cause organisations to produce below their maximum attainable output.

Advantages of adopting a SFA approach include:

- The stochastic frontier method allows for the decomposition of growth into changes in input use, changes in technology and changes in efficiency, thus extending widely used growth accounting methods.
- The standard definition of a production function is that it gives the maximum possible output for a given set of inputs; the production function therefore defines a boundary or a frontier. All the production units on the frontier will be fully efficient. Efficiency can be of two kinds: technical and allocative. Same as DEA.
- SFA model includes the effect of random shocks to the production frontier.
- SFA allows for statistical inference. Hence, we can test the specification as well as different hypotheses on the efficiency term and on all the other estimated parameters of the production frontier.
- The use of panel data allows for the separation of firm specific events that are not related to efficiency from technical efficiency.5
- Attempts to account for noise and environmental variables are easier to deal with.
- The basis of SFA (cost function and distance function) can deal with multiple outputs.

Some of the disadvantages inherent in SFA include:

- Several strong assumptions need to be imposed, in particular about the distribution of statistical noise (normal) and of technical inefficiency.
- In addition, the assumption that inefficiency is independent of the regressor may be incorrect.

- The decomposition of the error term into noise and efficiency components may be affected by the particular distributional forms specified and by the related assumption that error skewness is an indicator of inefficiency.
- Requires large sample size for robust estimates.

Applicability of stochastic frontier analysis to FCNSW harvest and haul costs

The feasibility of applying this approach to FCNSW will depend on the following factors:

- Having sufficiently large and varied sample size to estimate statistically significant results;
- The availability of multiple useful comparators, and information on other comparators (i.e. having sufficient comparators in order to produce an 'efficient frontier'); and
- The availability of highly accurate data on inputs and outputs including both price and quantity data.

Given that the analysis would need to be limited to harvest and haul operators in NSW, this would not provide for sufficient data to apply stochastic frontier analysis and would also be of limited benefit given the small number of firms involved.

4.4 Conclusions on the Application of Additional Analytical Approaches

As noted above, the potential future application of additional benchmarking techniques will be dependent on the availability of more comprehensive data and information in relation to harvest and haul operations. It is apparent that to a large extent this data is not currently being collected in a suitable form anywhere in Australia. As noted in the recommendations included in the Conclusions Section of this this report, we consider that FCNSW should consider the following:

- Cost data **–** FCNSW work towards the development of standardised cost data set for its harvest and haul operations by: contract, product, market, price and volume as suggested in Appendix C;
- Alternative approaches **–** FCNSW consider capturing additional data that may support the development of alternative approaches to benchmarking such as data on inputs and outputs of harvesting and haulage.
- Inter-jurisdictional data – further examine the feasibility and value of collecting additional data from other jurisdictions to provide the basis for the development of other benchmarking techniques such as productivity indexes in the future.

If FCNSW is in a position to develop cost data sets along these lines, it may be possible in future benchmarking reviews to reconsider the potential application and benefits of applying the three analytical techniques discussed above.

5. MARKET POWER ASSESSMENT

The scope of this report included consideration of the extent of any market power within local or regional markets for harvesting and haulage services. The key steps in the approach adopted for assessing market power were the following:

- *Market definition* – identifying the relevant market for harvest and haulage services including the different dimensions of the market
- *Market analysis* – analysis of the current state of the harvest and haulage market including operating arrangements, barriers to entry and participants (including market shares)
- *Market power assessment* – evaluating the extent of any market power in harvest and haulage services by assessing the structure of the market, trends in market concentration and commercial outcomes.

5.1 Market Definition

Defining the relevant market is key to considering the issue of market power as it provides the basis for isolating potential competition or market power issues and also potential constraints on market participants.

Section 2 of this report provided an overview of the native timber industry and supply chain in NSW. For the purposes of assessing the extent of any market power in the harvest and haulage component of this supply chain, we have focused on two market dimensions:

- *Product dimension* – what is typically meant by harvest and haulage services
- *Geographic dimension* – the area in which harvest and haulage services are provided.

5.1.1 Meaning of Harvest and Haulage Services (product dimension)

Harvest services

As discussed previously, harvest services comprise tree felling, extraction, log making and storage. In native timber operations, harvest operations typically include the loading onto trucks for transport to timber mills. Harvest operations are defined within FCNSW's standard Harvest Agreement with suppliers as meaning the following:

"Harvest Operations" means the felling of trees, servicing of trees into Log Products and Residue Products, extraction of trees or Log Products and Residue Products to Log Landings, segregation and stock piling of Log Products and Residue Products at Log Landings, and ancillary works including Loading Operations, track and Log Landing construction, and the moving of Equipment between Harvesting Units.

Haulage Services

Haulage services relate to the transport of logs to timber mills. Haulage operations are defined within FCNSW's standard Haulage Agreement with suppliers as meaning the following:

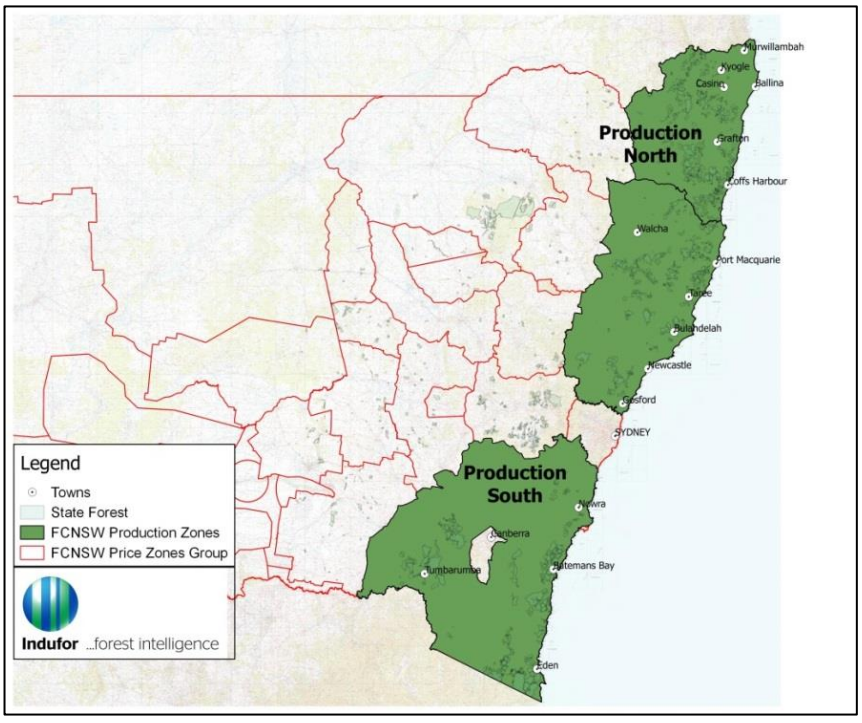
"Haulage Operations" means transportation of Log Products from Harvesting Unit to a Product Destination.

5.1.2 Geographic Market Boundaries (geographic dimension)

A key factor in market definition is also defining the boundaries of the market and any geographic dimension to the market. As illustrated in Figure 5-1 below, geography is a key factor in FCNSW's operational management structure for native timber production is based on two regional geographic zones:

- *Production North* – with annual production of around 460,000 m^3 per annum
- *Production South* – annual production of 110,000 m^3 on a mill door basis plus 260,000 m^3 stumpage.

Figure 5-1: FCNSW Regional Production Zones

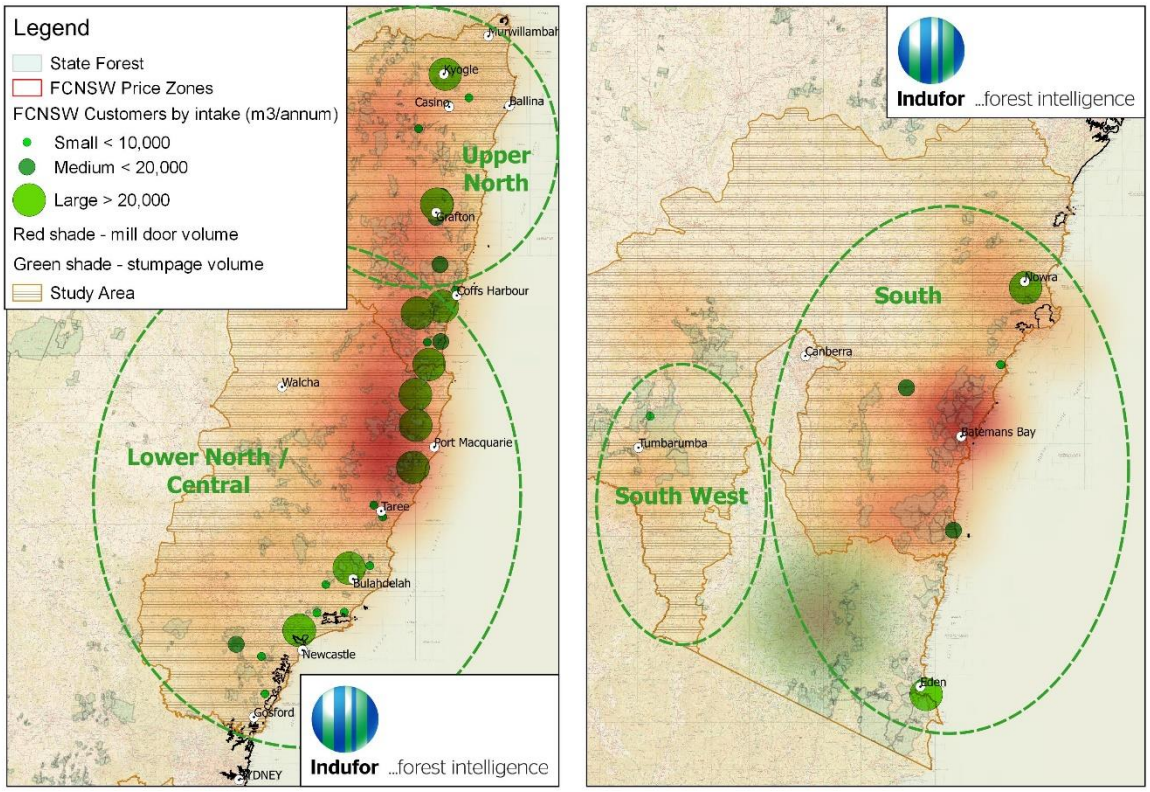


Source: FCNSW

As illustrated in Figure 5-2 below, FCNSW manages the provision of harvest and haulage services on the basis of four separate geographic areas (note these have been termed by the authors based on the market analysis and do not reflect FCNSW administrative units):

- Upper North;
- Lower North/Central;
- South (includes the market supplying services under stumpage arrangements); and
- South West.

Figure 5-2: Geographic Boundaries of Harvest and Haulage Services Market



Source: FCNSW

We understand that the determinants of these geographic boundaries are a result of the following:

- *Customer location* – proximity to native timber customers with an operational management target of product being harvested and transported from a location within 200 km of the customer (timber mills), and /or the contractors base. Distance from customer drives haulage costs and the delivered price to FCNSW's native timber customers; and

- *Underlying business economics of harvest and haulage operators* – the economics and operational requirements of harvest and haulage operators both in terms of travel time for labour and also proximity to enable management oversight of operations.

5.2 Market Analysis

5.2.1 Commercial Arrangements

As discussed in Section 2.4, the majority of native timber supplied by FCNSW is sold on a 'mill door' or 'delivered' basis where the price paid by the customer includes the growing, harvesting and transport costs to the mill gate. FCNSW separately contracts for harvest and haulage service with the costs of these services being incorporated as a pass through cost under the terms of the FCNSW customer supply agreements.

FCNSW separately procures harvest and haulage services through a tender process based on projected demand based long term and short term supply agreements and industry analysis of demand. FCNSW's standard agreements for harvest and haulage are generally for a term of five years with provisions for contract extensions. Shorter term contracts are also used where necessary to meet temporary or unforeseen demand or shortfall in capacity.

As outlined in Section 5.1 above, FCNSW procures harvest and haulage services on the basis of parcels or packages within the four geographic areas (Upper North, Lower North/Central, South and South West).

5.2.2 Barriers to Entry

Harvest services

The harvest services market is characterised by predominantly a number of smaller geographically based operators. As illustrated in Figure 3-8 the current profile (by revenue and volume) of harvest operators across the four geographic markets for the three years comprised one large, four medium and 15 smaller businesses. A total of ten businesses provide both harvest and haulage services.

The barriers to entry into the harvest services market include the following:

- Equipment – specialised plant for felling, snigging and processing logs
- Labour – machine operators, chainsaw operators and ancillary staff
- Expertise – knowledge of environmental regulations, log and market specifications, and safety requirements
- Location – accessibility to forests for transport of equipment, labour and management oversight.

In terms of substitutability, whilst there is some evidence of harvesting service providers operating in both the native forests and plantation forests, to a large extent equipment and expertise are not readily interchangeable.

There is some evidence of capital mobility, with two contractors based in Tasmania and Victoria respectively securing harvest contracts on the South Coast. However this has beens relatively limited and FCNSW have advised that whilst interest from interstate parties has occurred from time to time, rarely has this translated to a sustained presence in the NSW market.

Haulage Services

As illustrated in Figure 3-8 the current profile (by revenue and volume) of haulage operators across the four geographic markets for the three years comprised one large, two medium and 12 smaller businesses. A total of ten businesses provide both haulage and harvesting services.

The barriers to entry into the haulage services market include the following:

- Equipment – prime movers and log trailers
- Labour – truck drivers and ancillary staff
- Knowledge and expertise
- Location – accessibility to forests for transport of equipment, labour and management oversight.

In terms of substitutability, prime movers can be deployed to a limited number of non-forest sector users but while some trailers can be utilised for plantation logs, most trailers used in native timber haulage are designed specifically for native timber logs.

5.2.3 Market Participants and Market Share

Based on the information provided by FCNSW for the period 2013/14 to 2015/16 the current participants and market shares for each of the four geographic markets for harvest and haulage services are detailed in Table 5-1.

Table 5-1: Market Share Analysis for Harvest and Haulage Services FY2014-2016

	Harvest					Haulage			
Upper North	Revenue ($000)	Market Share ($)	Quantity ('000 gmt)	Market Share (gmt)		Revenue ($000)	Quantity ('000 gmt)	Market Share ($)	Market Share (gmt)
Contractor 1	15,669	50.8%	393	49.9%	Contractor 101	9,888	59.0%	449	57.0%
Contractor 2	3,645	11.8%	146	18.5%	Contractor 102	3,301	19.7%	173	21.9%
Contractor 3	2,619	8.5%	62	7.8%	Contractor 103	1,840	11.0%	85	10.8%
Contractor 4	2,548	8.3%	62	7.8%	Contractor 104	1,011	6.0%	47	6.0%
Contractor 5	2,228	7.2%	42	5.3%	Contractor 105	660	3.9%	32	4.1%
Contractor 6	1,961	6.4%	36	4.6%	Contractor 106	32	0.2%	1	0.1%
Contractor 7	1,613	5.2%	34	4.4%	Contractor 107	12	0.1%	0	0.1%
Contractor 8	345	1.1%	9	1.2%	Contractor 108	3	0.0%	0	0.0%
Contractor 9	195	0.6%	4	0.5%	Contractor 109	0	0.0%	0	0.0%
Upper North Total	**30,822**	**100.0%**	**788**	**100.0%**		**16,747**	**100.0%**	**789**	**100.0%**

Lower North / Cent	Revenue ($000)	Market Share ($)	Quantity ('000 gmt)	Market Share (gmt)		Revenue ($000)	Market Share ($)	('000 gmt)	Market Share (gmt)
Contractor 21	4,207	13.7%	114	14.0%	Contractor 121	7,603	38.2%	322	39.6%
Contractor 22	3,761	12.2%	106	13.1%	Contractor 122	6,710	33.8%	229	28.1%
Contractor 23	3,240	10.5%	91	11.2%	Contractor 123	3,199	16.1%	163	20.0%
Contractor 24	2,975	9.7%	85	10.5%	Contractor 124	2,030	10.2%	88	10.8%
Contractor 25	3,506	11.4%	84	10.4%	Contractor 125	295	1.5%	8	1.0%
Contractor 26	2,389	7.8%	65	8.0%	Contractor 126	0	0.0%	3	0.3%
Contractor 27	1,897	6.2%	61	7.5%	Contractor 127	43	0.2%	2	0.2%
Contractor 28	2,707	8.8%	57	7.0%	**Total**	**19,879**	**100.0%**	**814**	**100.0%**
Contractor 29	2,051	6.7%	50	6.1%					
Contractor 30	1,497	4.9%	33	4.1%					
Contractor 31	990	3.2%	24	3.0%					
Contractor 32	778	2.5%	20	2.4%					
Contractor 33	302	1.0%	11	1.3%					
Contractor 34	217	0.7%	6	0.7%					
Contractor 35	183	0.6%	3	0.4%					
Contractor 36	64	0.2%	2	0.2%					
Total	**30,765**	**100.0%**	**814**	**100.0%**					

South	Revenue ($000)	Market Share ($)	Harvest Quantity ('000 gmt)	Market Share (gmt)		Revenue ($000)	Market Share ($)	Haulage Quantity ('000 gmt)	Market Share (gmt)
					South				
Contractor 201	2,420	31.5%	77	30.6%	Contractor 221	2,400	31.9%	86	34.2%
Contractor 202	1,950	25.4%	62	24.3%	Contractor 222	1,300	17.3%	48	18.9%
Contractor 203	1,162	15.1%	42	16.4%	Contractor 223	1,427	19.0%	46	18.2%
Contractor 204	1,076	14.0%	33	13.0%	Contractor 224	1,201	16.0%	31	12.2%
Contractor 205	772	10.0%	28	11.3%	Contractor 225	455	6.0%	17	6.8%
Contractor 206	176	2.3%	7	2.8%	Contractor 226	507	6.7%	15	6.1%
Contractor 207	60	0.8%	2	0.9%	Contractor 227	236	3.1%	9	3.6%
Contractor 208	68	0.9%	2	0.7%	**Total**	**7,527**	**100.0%**	**252**	**100.0%**
Total	**7,683**	**100.0%**	**253**	**100.0%**					
South West					**South West**				
Contractor 209	1,319	100.0%	49	100.0%	Contractor 228	1,347	100.0%	49	100.0%

Source: FCNSW

Note: The analysis used in this table utilises the forest source to identify the 'market'. This differs slightly from the data presented in Table 5-3 and Table 5-4 that identified the 'market' through the contractors' location.

A summary of the number of operators and vertically integrated operators (providing both harvest and haulage services) is outlined in Table 5-2 below.

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Table 5-2: Harvest and Haul Contractor Numbers FY2014-2016

	Upper North	Lower North/Central	South	South West
No. Harvest contractors	9	16	8	1
No. Haulage contractors	8	7	7	1
No. Vertically integrated contractors	3	4	-	1

In terms of market entry and exit in harvest and haulage services, historic data was also available from FCNSW for the past twelve years as detailed in Table 5-3 and Table 5-5 on the following pages.

Table 5-3: Harvest Services Market Participation for the Period FY2005-2016

Source: FCNSW

Table 5-4: Haulage Services Market Participation for the Period FY2005-2016

Contractor ID												
Upper North	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_82												
FC_83												
FC_84												
FC_85												
FC_86												
FC_87												
FC_88												
FC_89												
Lower North / Central												
FC_50												
FC_51												
FC_52												
FC_53												
FC_54												
FC_55												
FC_56												
FC_57												
South												
FC_58												
FC_59												
FC_60												
FC_61												
FC_62												
FC_63												
FC_64												
FC_65												
FC_66												
FC_67												
FC_68												
FC_69												
FC_70												
South-west												
FC_71												
FC_72												
FC_73												

Source: FCNSW

Note: The analysis used in this table utilises the contractors' location to identify the 'market'. This differs slightly from the data presented in Table 5-1 that identified the 'market' through the forest source. Where the markets are closely related, as is the case for Upper North and Lower North / Central, contractors operating across both markets are not evident from this table.

A summary of the number of contractors including operators entering and exiting the market is outlined in Table 5-5 below.

Table 5-5: Harvest and Haul Contractor Participation Trends FY2005-2016

	Upper North	*Lower North/Central*	*South*	*South West*
No. harvest contractors over the period	17	19	9	3
No. haulage contractors over the period	8	8	12	3
No. harvest contractors entering market	3	3	8	1
No. harvest contractors exiting market	3	4	6	2
No. haulage contractors entering market	1	3	10	1
No. haulage contractors exiting market	2	5	6	1

Source: FCNSW

This illustrates that there is evidence of competition for the market for both harvest and haulage services across the four geographic markets for the period 2005 to 2016.

5.3 Market Power Assessment

The analysis outlined in Section 5.2 above, indicates that the market for both harvest and haul are competitive based on the analysis of the number of active operators providing services in the geographic markets identified. Evidence of a competitive environment is also supported by the analysis of the contractor number trends including entry and exit over the previous 12 years detailed in Table 5-5 below.

Whilst the activity and trend data indicate the harvest and haulage services markets are contestable, to consider whether there may be market power within local or regional markets for harvest and haul services we have considered the following:

- The trends in market concentration for the provision of both harvest and haulage services in the identified geographic markets
- The current market structure and basis on which harvest and haulage services are procured by FCNSW
- Pricing for harvest and haulages services over the three year period.

5.3.1 Trends in Market Concentration

Data provided by FCNSW provided the basis for tracking the trends in contractor market shares over the last 12 years. This provides a basis for identifying whether there may be any indication of market power within the four geographic markets based on changes to harvest and haulage contractor market share. The market share trends are detailed in Table 5-6 below, using volume as the basis for comparison.

Harvest contractor market share trends

Based on data provided by FCNSW, the market share trends for harvest contract services over the past 12 years is provided in Table 5-6 and below. Note – The colour shading indicates high (green) and low (red) market share.

Table 5-6: Harvest Contractor Market Share Trends FY2005-FY2016

Upper North

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_38	28%	29%	31%	30%	28%	28%	33%	37%	40%	47%	49%	49%
FC_39	27%	23%	26%	27%	28%	31%	29%	25%	21%	18%	17%	18%
FC_40	0%	6%	13%	13%	13%	13%	12%	14%	12%	11%	12%	11%
FC_41	12%	9%	0%	0%	2%	3%	4%	3%	7%	7%	8%	8%
FC_42	2%	1%	7%	6%	5%	6%	6%	5%	1%	0%	0%	0%
FC_43	0%	14%	12%	6%	6%	1%	0%	0%	0%	0%	0%	0%
FC_44	1%	4%	5%	9%	8%	2%	0%	1%	2%	0%	0%	0%
FC_45	0%	0%	0%	1%	4%	4%	6%	6%	5%	0%	0%	0%
FC_46	0%	0%	0%	0%	0%	12%	10%	1%	0%	0%	0%	0%
FC_47	0%	0%	0%	0%	0%	0%	0%	2%	4%	6%	5%	6%
FC_48	0%	0%	0%	0%	0%	0%	0%	3%	5%	4%	5%	4%
FC_49	18%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_50	9%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_51	0%	0%	3%	5%	5%	0%	0%	0%	0%	0%	0%	0%
FC_52	3%	4%	3%	3%	1%	0%	0%	0%	0%	0%	0%	0%
FC_53	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	5%	5%
FC_54	0%	0%	0%	0%	0%	0%	0%	2%	3%	3%	0%	0%

Lower North/Central

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_1	20%	20%	16%	19%	22%	21%	24%	22%	24%	24%	22%	21%
FC_2	19%	18%	21%	23%	22%	24%	23%	23%	22%	10%	16%	15%
FC_3	9%	9%	10%	13%	17%	20%	20%	19%	14%	17%	17%	15%
FC_4	4%	6%	7%	10%	11%	9%	9%	9%	8%	10%	11%	12%
FC_5	9%	9%	8%	6%	7%	7%	8%	8%	8%	7%	0%	0%
FC_6	5%	5%	5%	7%	5%	5%	4%	3%	4%	4%	4%	5%
FC_7	0%	0%	0%	0%	0%	0%	0%	4%	6%	11%	11%	11%
FC_8	5%	6%	5%	5%	6%	5%	0%	0%	0%	0%	0%	0%
FC_9	2%	3%	4%	3%	2%	3%	3%	4%	1%	0%	0%	0%
FC_10	0%	0%	0%	0%	0%	0%	2%	3%	4%	5%	6%	8%
FC_11	0%	3%	14%	5%	0%	0%	0%	0%	0%	0%	0%	0%
FC_12	0%	0%	0%	0%	0%	0%	0%	0%	3%	8%	9%	8%
FC_13	4%	4%	2%	2%	2%	1%	1%	1%	2%	1%	1%	1%
FC_14	6%	6%	5%	3%	0%	0%	0%	0%	0%	0%	0%	0%
FC_15	0%	0%	0%	1%	2%	2%	2%	2%	3%	3%	3%	3%
FC_16	2%	1%	2%	2%	2%	2%	2%	2%	1%	0%	0%	0%
FC_17	8%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_18	4%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_19	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%

South

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_20	0%	0%	0%	0%	0%	1%	19%	23%	22%	26%	26%	30%
FC_21	36%	39%	33%	26%	17%	17%	15%	16%	13%	16%	9%	0%
FC_22	0%	0%	0%	13%	19%	18%	19%	17%	20%	17%	11%	13%
FC_23	0%	0%	0%	9%	17%	13%	13%	11%	10%	13%	13%	18%
FC_24	29%	22%	21%	22%	16%	12%	10%	8%	8%	7%	3%	0%
FC_25	0%	0%	0%	0%	0%	0%	0%	10%	15%	21%	22%	25%
FC_26	0%	0%	0%	4%	11%	13%	11%	11%	10%	0%	0%	0%
FC_27	0%	0%	1%	13%	16%	15%	11%	0%	0%	0%	0%	0%
FC_28	0%	0%	0%	0%	0%	0%	0%	4%	3%	0%	15%	14%
FC_29	18%	26%	31%	8%	0%	0%	0%	0%	0%	0%	0%	0%
FC_30	0%	0%	0%	4%	4%	10%	1%	0%	0%	0%	0%	0%
FC_31	16%	12%	14%	1%	0%	0%	0%	0%	0%	0%	0%	0%

South West

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_32	49%	55%	60%	56%	46%	27%	11%	20%	29%	100%	100%	100%
FC_33	51%	45%	40%	44%	54%	73%	89%	0%	0%	0%	0%	0%
FC_34	0%	0%	0%	0%	0%	0%	0%	80%	71%	0%	0%	0%

Source: FCNSW

Note: The analysis used in this table utilises the contractors' location to identify the 'market'. This differs slightly from the data presented in Table 5-1 that identified the 'market' through the forest source. Where the markets are closely related, as is the case for Upper North and Lower North / Central, contractors operating across both markets are not evident from this table.

Based on the data provided by FCNSW above, it does appear that the market share captured by contractors providing harvest services have moved over time indicating a degree of competition across all markets.

In the Upper North market, one observable trend has been the steady capture of market share of the largest operator, who now has close to 50% of the contract harvest market. The market position of this contactor is also evident in their size relative to all other harvest and haulage contractors (as illustrated in Figure 3-8).

Whilst this share of market in itself does not indicate a market power issue, it is relevant to explore what has driven this competitive position relative to other contractors in Upper North market (and the combined markets as a whole). We understand from FCNSW that the factors driving this market position include the following:

- Long standing family based business who been vertically integrated at times into harvesting and haulage
- Ongoing demonstrated high level of expertise in native forests harvesting and haulage
- Have been competitive on price but also highly flexible in terms of location, large working circle and backup equipment and surge capacity
- Proven track record of meeting production targets and other non-price criteria.

The average unit cost for each contractor has been analysed in terms of the market share held by the firm. For the Upper North, Lower North/Central and South markets, in all cases the top three contractors' unit costs are between 2% and 38% below the median cost for that market, suggesting that the larger firms tend to have a cost competitive advantage, rather than leveraging their market share to obtain above market rates.

A comparison of enterprise size and number of participants, using annual volume as a comparison in Tasmania and WA is provided below. This indicates differing market structures across these two states, with the Tasmanian market being relatively fragmented while WA is relatively concentrated.

Figure 5-3: Contract Size by Volume for Tas and WA

Source: FT, FPC

No specific data is available to identify where contractors are providing both harvest and haulage services, however Indufor understand the bulk of harvesting contractors in Tasmania and WA also complete the function of transporting the logs that they produce ('stump to mill operations'). This is not uncommon in the industry, as it provides the opportunity to optimise harvesting operations by ensuring that logs can be uplifted on a regular and predictable basis. Similarly, in Victoria transport services can be completed through separate arrangements, so both approaches are in place across native forest operations.

Haulage contractor market share trends

Based on data provided by FCNSW, the market share trends for haulage contract services over the past 12 years is provided in Table 5-7 below.

Table 5-7: Haulage Contractor Market Share Trends FY2005-2016

Upper North

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_82	46%	49%	44%	41%	43%	45%	44%	48%	52%	54%	54%	30%
FC_83	46%	33%	30%	33%	29%	29%	28%	24%	22%	21%	19%	12%
FC_84	0%	12%	20%	22%	22%	22%	24%	26%	22%	21%	20%	10%
FC_85	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	44%
FC_86	0%	0%	0%	0%	2%	2%	3%	3%	4%	5%	7%	3%
FC_87	5%	6%	6%	4%	1%	0%	0%	0%	0%	0%	0%	0%
FC_88	0%	0%	0%	1%	3%	2%	0%	0%	0%	0%	0%	0%
FC_89	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Lower North/Central

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_50	53%	51%	48%	46%	45%	45%	44%	43%	47%	41%	43%	40%
FC_51	13%	24%	38%	45%	51%	51%	50%	52%	50%	59%	57%	59%
FC_52	25%	18%	14%	7%	0%	0%	0%	0%	0%	0%	0%	0%
FC_53	0%	0%	0%	2%	4%	3%	3%	2%	0%	0%	0%	0%
FC_54	6%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_55	0%	0%	0%	0%	0%	1%	2%	2%	2%	0%	0%	0%
FC_56	3%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FC_57	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%

South

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_58	87%	89%	90%	54%	30%	28%	41%	36%	45%	51%	47%	26%
FC_59	0%	0%	0%	11%	21%	23%	16%	16%	11%	14%	17%	19%
FC_60	13%	7%	6%	14%	17%	15%	14%	14%	14%	17%	24%	16%
FC_61	0%	0%	0%	3%	6%	18%	20%	19%	21%	18%	12%	15%
FC_62	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%
FC_63	0%	4%	3%	8%	11%	7%	3%	1%	0%	0%	0%	0%
FC_64	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%
FC_65	0%	0%	0%	0%	4%	4%	4%	3%	1%	0%	0%	0%
FC_66	0%	0%	0%	5%	4%	5%	1%	0%	0%	0%	0%	0%
FC_67	0%	0%	0%	0%	0%	0%	0%	5%	7%	0%	0%	0%
FC_68	0%	0%	0%	6%	8%	0%	0%	0%	0%	0%	0%	0%
FC_69	0%	0%	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%
FC_70	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

South West

Period

Contractor	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
FC_71	49%	53%	59%	56%	46%	23%	9%	11%	30%	100%	100%	100%
FC_72	51%	47%	41%	44%	54%	77%	72%	0%	0%	0%	0%	0%
FC_73	0%	0%	0%	0%	0%	0%	20%	89%	70%	0%	0%	0%

Source: FCNSW

Comment on market share trends for haulage contractors

Based on the data provided by FCNSW above, it does appear that the market share captured by contractors providing haulage services have moved over time indicating a degree of competition across all markets.

In the Upper North and Lower North market, one observable outcome is emergence of North Haul in 2016 who had 44% of the haulage services market in Upper North[6] in 2015/2016, after being

[6] North Haul operate across Upper and Lower North – the data analysis did not attempt to identify the proportion of volume within each market, given this was only relevant for the last 4 months of the 3 year period.

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awarded all the northern haulage work in early 2016. We understand from FCNSW that North Haul is a consortium of incumbent haulage contractors. And has resulted from a direct negotiation between FCNSW and these contractors. We understand the driver for this direct negotiation process was the high level of tendered prices for the Upper and Lower North market in the 2015 tender process, and that the consortium was able to provide more competitive pricing for haulage services in this market.

5.3.2 Influence of Market Structure

The structure of the market for harvest and haulage services is highly relevant for considering the extent to which there may be market power issues in local or regional markets for harvest and haulage. As previously discussed in Section 3, there are structural features of the harvest and haulage market that are relevant for considering the issue of market power in the harvest and haulage market, these are:

- The role of FCNSW as the purchaser of harvest and haulage service
- The potential for countervailing power from FCNSW's timber customers.

5.3.3 FCNSW's Procurement Strategy

FCNSW procurement strategy has evolved over time, adapting to changing markets, service requirements, probity constraints and the corporate operating environment. Since transitioning from a GTE to State Owned Corporation in 2013, there has been a stronger commercial oversight and a more flexible approach to procurement, whilst still being subject to ICAC Guidelines.

An example of this evolution is the process that stemmed from a review of harvest and haulage services procurement in 2010. To that point, open tendering had been based on calling for bids for parcels of work based on harvesting areas and associated 'difficulty classes'. Prices were based on a green metric tonne (or in some cases m^3), and the contractor was responsible for understanding and predicting productivity levels and product mix, in order to ensure the pricing was sustainable.

Because of the extremely wide variation in operating conditions and hence productivity, FCNSW undertook to help manage the risk of productivity levels, calling for bids based on a crew day rate (CDR) – that is, a rate for the supply and maintenance of labour and equipment on a daily basis. Tenders on Sample Compartments stated CDR and Daily Production Rates (DPR) and from there, prior to commencing each harvesting area, the contractor and FCNSW would estimate the daily production rate to then derive an individual harvest rate for that area.

Whilst this process achieved one objective in terms of improving the understanding of productivity and pricing, and deriving a rate appropriate for a specific circumstance, from a price setting perspective there were shortcomings in that bidders, particularly from outside the industry, did not have a strong understanding of productivity drivers and the sample harvest areas were not

described accurately in all cases. This led to a time consuming and complex process top establish rates for individual areas.

After further review in 2015, FCNSW returned to open tenders for unit pricing. However, as the market response was poor, particularly on the South Coast, direct negotiation with existing firms was seen as the best means to achieve reasonable outcomes.

FCNSW procurement policy enables direct negotiations after considering the following;

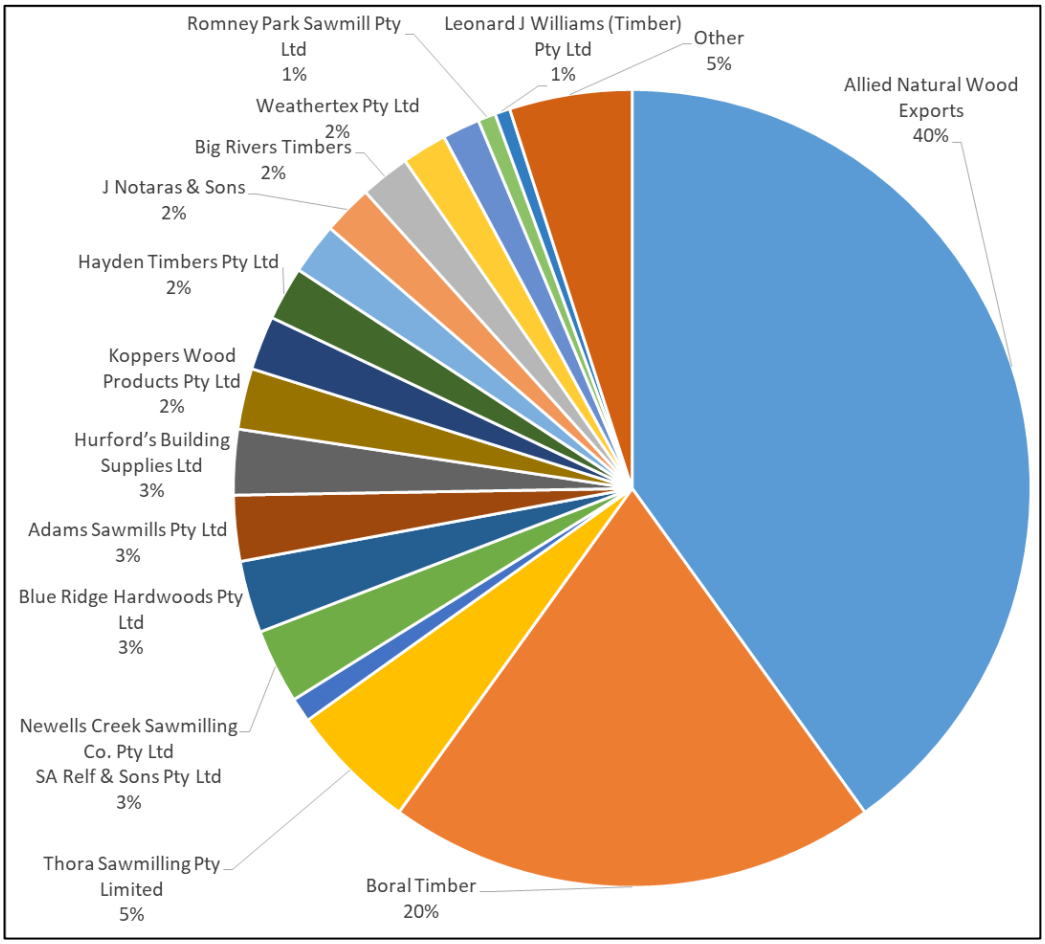
- Are existing contractors performing to contract requirements?
- Has the supply base in the market substantially changed?
- Has the technology employed substantially changed?
- Does the supplier costs remain competitive?

In summary, FCNSW procurement strategy needs to address an increasing complexity of the operating environment (regulatory, nature of resource and risk), and in what is in essence a managed market, balance the appropriate allocation of risk between FCNSW and the suppliers, a constrained market for services, whilst ensuring there is sufficient competitive tension to achieve cost competitive prices. On this basis, it is expected that future contracts will be awarded through a combination of market exploration via tenders and expressions of interest, and direct negotiations where required in order to contain costs.

5.4 Countervailing Power of FCNSW's Timber Customers

As detailed in Figure 5-4 below, FCNSW's native timber customers include a number of larger businesses, with ANWE and Boral receiving over 60% of all logs from FCNSW forests, noting that the majority of the ANWE volume is harvested on a 'stumpage' basis and is thus subject to a different market dynamic, in that ANWE have direct commercial relationships with the harvest and haul contractors.

Figure 5-4: FCNSW Customer Allocation



Source: FCNSW

As discussed previously, FCNSW's supply agreements with its native timber customers provide for dispute over the level of harvest and haulage prices. As harvest and haulage costs are estimated to comprise approximately 58% of the delivered price of native timber, the overall level of harvest and haulage costs significantly impact commercial outcomes both for FCNSW and its log customers. FCNSW's customers have a degree of countervailing power through contractual recourse in relation to harvest and haul costs if they consider the pass through costs for harvest and haulage are not reasonable.

In addition, over 50% of the log volume sold by FCNSW annually is under a Delivered Price arrangement (refer to section 2.4.1). Therefore, there is a strong market incentive on FCNSW to minimise harvest and haul costs and thereby maximise residual stumpage from these other log sales.

5.5 Pricing Outcomes

Another potential indicator of the extent of any market power in local or regional markets for harvest and haulage are pricing outcomes.

Table 5-8 below details the average unit prices that have been paid by FCNSW for harvest contracts over the three year period covered by this review.

Table 5-8: Rate of Change – FCNSW Harvest Unit Costs (per gmt)

Harvest ($ per gmt)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	37.54	38.66	39.54	2.01
Annual Change		*3.0%*	*2.3%*	
Total Change				*5.3%*
Production South	27.65	30.43	30.15	2.50
Annual Change		*10.1%*	*-0.9%*	
Total Change				*9.1%*
Total	36.80	37.41	37.33	0.53
Annual Change		***1.6%***	***-0.2%***	**0.7%**
Total Change				***1.4%***

Source: FCNSW

Table 5-9 below details the average unit prices that have been paid by FCNSW for haulage contracts over the three year period covered by this review.

Table 5-9: Rate of Change – FCNSW Haulage Unit Costs (per tkm)

Haulage ($ per gmt)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	21.99	23.31	23.27	1.28
Annual Change		*6.0%*	*-0.2%*	
Total Change				*5.8%*
Production South	32.39	29.47	28.19 -	4.21
Annual Change		*-9.0%*	*-4.4%*	
Total Change				*-13.4%*
Total	22.76	24.25	24.43	1.67
Annual Change		***6.5%***	***0.8%***	**3.6%**
Total Change				***7.3%***

Source: FCNSW

From the data available, unit costs for both harvest and haul services have been maintained below the Sydney CPI of 1.95% for the 3 year period. No data was available, nor was it within scope of

the study, to compare longer term trends and therefore the impact of market power over a longer period of time.

5.6 Conclusions

The activity and trend data in relation to the number of operators participating in FCNSW's procurement processes indicate a level of contestability for the provision of harvest and haulage services in the markets identified, albeit in a managed market. To consider whether there may be market power within local or regional markets for harvest and haulage services we have considered the following:

- The trends in market concentration for the provision of harvest and haulage services in the identified geographic markets;
- The current market structure and basis on which harvest and haulages services are procured by FCNSW; and
- Pricing for harvest and haulage services over the three year period considered for this review.

Based on the available data and information in relation to these three areas, while FCNSW is the predominant purchaser of these services, it would appear that the market for the provision of harvest and haulage services in the identified geographic markets result from a contestable process and that the market concentration and pricing outcomes over the three years covered by the review do not appear to highlight potential market power in local or regional markets.

6. COST RECOVERY ANALYSIS

6.1 Background

As discussed in Section 2.4.1, FCNSW sells logs under different arrangements to a number of customers across the state. The majority of the timber supplied by FCNSW from native forest is sold on a 'mill door' or 'delivered' basis – that is, the price customers pay for the logs includes the growing, harvesting and transport costs to the mill gate. In some cases, FCNSW commercial arrangements provide for the customers to engage harvesting and haulage contractors directly, thereby purchasing logs purely on a 'stumpage' basis.

The project scope required an analysis of whether FCNSW recovers the full cost of harvest and haul expenses and the cost of administering these contracts under mill door sales. In addition, a comparison of the costs of managing mill door sales relative to stumpage sales, and an evaluation of the risks and benefits that the two approaches offer is provided.

In calculating the delivery charge FCNSW estimate the harvest and haul costs that will be incurred in the delivery of logs during the period, and where provided for in contracts, an additional administration charge. This analysis tests whether these estimated costs are being recovered through the revenue derived from the delivery charges.

Terms used in this section include:

Administration cost – the calculated cost per m^3 based on FTE allocations for FCNSW to manage and administer harvest and haulage services (estimated to be \$3-60 per m^3 based on the methodology described below)

Administration charge – the amount FCNSW may charge customers to manage and administer harvest and haulage services. This amount is specified in most supply contracts. These are indexed annually and are currently respectively \$1-85 and \$2-60 per m^3 for the North Coast and South Coast.

Contract costs – contractor payments for providing harvest and haul services

Delivery charge – part of the total charge (in addition to stumpage) to customers that ostensibly covers contract costs and administration charges.

Operating margin – delivery charge revenue less contract costs.

This analysis does not consider revenue associated with the stumpage component of the customer charge, nor any consideration of FCNSW costs other than those directly related to contract harvesting and haulage, and internal administration and management of those contract services.

6.2 FCNSW Staffing Costs

FCNSW provided an organisation structure which identifies the roles of staff, and their potential involvement in managing the harvesting operations. The positions identified in FCNSW organisational structure that are relevant to managing harvesting operations are outlined in

Appendix B. Of note is that these positions involve undertaking the management and supervision of harvesting crews that encompasses production, safety and environmental compliance. As such, attributing the cost of these positions purely to production – that is, the 'mill door' component – is problematic. FCNSW does not attempt to account for these costs separately.

There are 8 dedicated positions in the structure such as the Sales and Distribution Managers that would not be required under stumpage sales, and 24 positions whose tasks would still be required to be fulfilled in part in order to implement FCNSW role as a forest owner. These positions have had costs attributed to managing harvest and haul operations at 50% per FTE. In addition, on the South Coast, positions are also involved in managing the stumpage operations as part of the role, and hence the proportion of their attributable cost has been further reduced to 25%.

On this basis, a breakdown of positions and an estimate of wages, support costs and overheads applied in this analysis is shown in the table below.

Table 6-1: FCNSW Harvesting and Delivery Personnel and Associated On-Costs

Item	%	Number	$
Dedicated Managers	100%	2	
Dedicated Supervisors	100%	2	
Dedicated Coordinators	100%	4	
50% Harvesting Managers	50%	1	
50% Harvesting Supervisors	50%	2	
50% Harvesting Coordinators	50%	13	
25% Harvesting Managers	25%	1	
25% Harvesting Supervisors	25%	2	
25% Harvesting Coordinators	25%	5	
Capital related items (depreciation and interest)		None advised	
Total		32	2,158,875

Source: FCNSW

With an average annual volume in the order of 600,000m^3, the average cost would equate to approximately \$3-60 per m^3. Indufor considers this is within the range expected for typical management costs in the industry, particularly associated with native forest operations, in terms of both a unit cost and volume per FTE basis[7].

6.3 Revenue

As discussed in Section 2.4.1, in determining the total charge applied to logs sold to customers on a mill door basis, FCNSW will calculate;

[7] Refer to VicForests Annual Report 2015/2016 p.20 and Forestry Tasmania Annual Report 2015/2016

1. The stumpage component that reflects the cost of growing and managing the forest,
2. The delivery charge that includes;
    a. An estimate of contract harvest and haul costs for a given period (generally a financial year). There are some uncertainties encapsulated in these estimates, including which contractor and therefore which rates will precisely apply to a specific harvesting area.
    b. Where applicable, an administration charge. Log supply contracts for HQ sawlog deliveries on the North Coast, and for most grades on the South Coast provide for the inclusion of an administration charge. These are indexed annually and are currently $1-85 per m^3 for the North Coast and $2-60? per m^3 for the South Coast. Note that this administration charge is less than the administration costs which have been calculated to be $3-60 per m^3 as stated above.

Average delivery charges and changes over the review period are detailed below.

Table 6-2: Average Delivery Charges 2013 - 2016

Delivery Charge ($ per m3)				
REGION	2013/2014	2014/2015	2015/2016	Change 2013-16
Production North	69.81	72.69	74.54	4.72
Annual Change		*4.1%*	*2.5%*	
Total Change				*6.7%*
Production South	70.76	67.85	68.44	-2.33
Annual Change		*-4.1%*	*0.9%*	
Total Change				*-3.3%*
Total	69.88	71.96	73.12	3.24
Annual Change		***3.0%***	***1.6%***	**2.3%**
Total Change				***4.6%***

Source: FCNSW

Changes in delivery charges can be a result of increased contract rates, as well as changes in operational factors such as longer transport distances or a higher proportion of difficult harvesting conditions. Overall, an average annual increase of 2.3% is evident from the aggregated data.

However, FCNSW accounts do not identify the component of the delivery charge associated with administration, and as such it is only possible to report on whether the total delivery charge effectively covers both contract and administration costs.

6.4 Cost Recovery

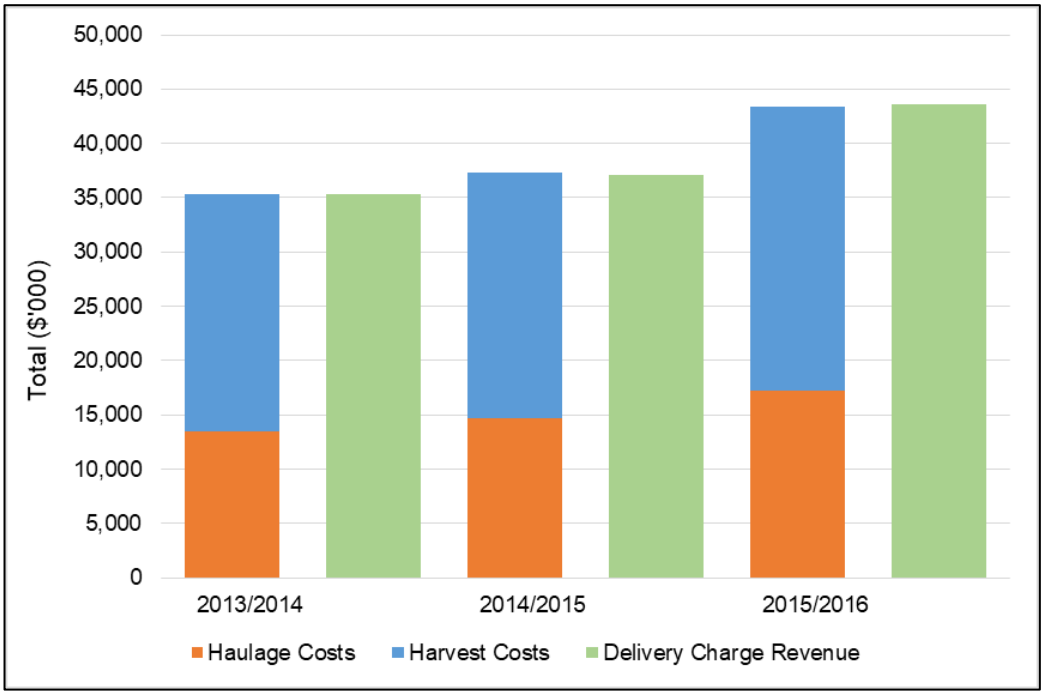
FCNSW are entitled to recover costs of harvesting and haulage services and the administration of those services.

The delivery charge revenue, accruing over the 3 year period, is detailed in Figure 6-1. As discussed, the delivery charges may include the administration fee that recognises FCNSW costs discussed in Section 6.2. However, FCNSW accounts do not identify where the administration fee is applied.

When revenue is compared with the contract costs over the same period;

- There are differences between the regions as the Production North total operating margin (delivery charges less third party contract costs) is approximately $670,000 over the 3 years, offset by a negative margin of $580,000 in the Production South region. However overall, FCNSW is recovering all contract costs associated with delivering logs to customers over the review period.
- The average operating margin over the period is $0-05 per m^3. Assuming that FCNSW administration costs are approximately $3-60 per m^3, this indicates that FCNSW are only partially recovering administration costs. Figure 6-1 demonstrates that FCNSW are recovering all contracts costs through the application of the delivery charge, however there is insufficient surplus to cover the administration costs.

Figure 6-1: Contract Costs (Harvest and Haul) and Delivery Charge Revenue 2013 - 2016



Source: FCNSW

There are a number of possibilities that could contribute to this outcome:

- The methodology to calculate FCNSW costs in Section 6.2 may overstate the proportion of FTE's associated with managing mill door sales.

- Whilst FCNSW may include administration charges in the calculation of total delivered log prices for some customers, the accounting methodology may only allocate contract costs to the delivery charge of the total log price. If this is the case, administration costs may be covered by the log stumpage component.
- FCNSW is underestimating the expected delivery charge. This may arise if more expensive contractors are assigned to harvest areas over the course of the year, or plans change due to unforeseen circumstances such as wet weather.

In summary, FCNSW delivery charges appear to be commensurate with third party contracted costs over the three year period overall. However from the data available, on average, only a minor part of the administration cost is being recovered from the delivery charge, and the degree to which all costs are recovered varies between regions.

6.5 Benefits and Risks of Managing Mill Door Sales

Mill door sales has become commonplace as a method of log sales used by forest managers across Australia. This includes both native forest and plantation log sales arrangements, and reflects a trend away from stumpage sales that is observed across both public entities and private owners or managers of forests.

Mill door sale is commonly assumed as to be the transfer of the property rights in the log occurring on the delivery of the log to a mill gate. As previously noted, mill door sales can include a 'pure' mill door sale where the cost paid to the forest owner is a defined price that is not adjusted by the actual harvesting and haulage charges. In this case, for example, the forest owner benefits or loses depending on the distance they need to transport the logs so as to honour the agreed log sale arrangement.

An alternative treatment of mill door is where the price paid by the log buyer is still where property rights transfer on the point of delivery to a mill door, but the price is a combination of stumpage plus the actual harvesting and haulage charge. In this treatment, the log buyer is incurring the risk in respect to actual harvesting and haulage charges, while the forest owner is bearing a narrower form of risk, primarily in relation to the services of the contracting parties (i.e. health and safety) and ensuring log sales align with log supply agreements between the forest owner and log buyer.

FCNSW utilise a combination and approximation of these different methods of selling timber mill door. For high quality sawlog products on the north coast and sawlog products on the south coast, it approximates the second method, whereby FCNSW forecast what the likely harvest and haul costs are for different geographical zones, rather than charge the customer the actual costs for harvest, haul and administration. For all other mill door sales FCNSW establish a Delivered Price for a customer from different geographical zones at the commencement of an agreement and are from that point on dependant on indices and managing the costs of harvest and haul to achieve a residual value that can be attributed as stumpage.

The trend to mill door sales has been most apparent whereby a forest owner has a range of log products arising from forest harvesting, and a range of log customers, some of whom are seeking the same log type while others might be focused on a specific log grade. In this situation, the

challenge for the forest owner is to ensure they maximise the return from the harvest by optimising the selling of the logs in a manner which maximises the return to the log seller, as well as equitably treating the parties who compete to secure the same log product.

A range of aligned benefits are also secured in mill door sales, such as those noted earlier like better control of environmental, and health and safety performance. However, the primary objective is securing an optimised sale of logs to the suite of log customers, and completing this in an independent manner in respect to competition by log buyers of the same log type. To this end, the forest owner may choose to identify and sell logs to a market with a higher financial risk, than which may occur under stumpage arrangement. This is particularly the case with low value residual logs, where margins are low, but the sale of which may offer other benefits including better silvicultural outcomes and greater utilisation of the roading network.

The alternative model of stumpage sales, where the wood processing industry arranges the harvesting and haulage, creates significant challenges in respect to treatment of conflicts of interest, maintenance of equity of supply, and in alignment with government industry policy.

In stumpage sales, to align with contemporary environmental frameworks, the harvesting operation needs to be completed as a single operation harvesting all potential products from the harvest coupe. Therefore a harvesting and haulage operation needs to be controlled by an entity which is able to represent the interests of all log customers, irrespective of their size and requirements. Establishing and managing such an entity is challenging, particularly in a situation where the customer base feature a dominant party(ies), and smaller operations face difficulty securing their desired log delivery schedule.

Similarly conflicts include the capacity to ensure the log grades being delivered are optimising the return to the forest owner and align with the supply agreements between the forest owner and log processor. A further challenge relates to the potential for processor managed harvest and haulage services to overly reinforce the merits of incumbency, and can provide further barriers to entry for new participants seeking to secure a log supply.

Mill door sales do incur an additional suite of risks compared to a stumpage sale. These risks include:

- A significant increase in use of the forest owner's working capital, given harvest and haulage costs are incurred to third party contractors. This working capital risk is not only a significant expansion of working capital requirements but also risk of delayed or non-payment of log purchases while retaining burden of payment to the harvest and haulage contractors;
- A greater exposure to the health and safety outcomes arising from harvest and haulage contracting services. These risks can be framed by contractual arrangements and performance assessment of the contractors, however a significant additional risk will reside with the party completing the mill door sale compared to a stumpage sale whereby the log buyer bears that risk.
- Dependent on the term and agreed log supply contract conditions, a mill door sale arrangement can amplify how a contract might adjust between years. For example, it is commonplace to regularly (i.e. annually, six monthly) adjust log prices based on a suite of agreed price and cost

metrics. These adjustment mechanisms can result in both more and less favourable log price outcomes than expected at the time the contracts were entered into. Management of this risk can be observed in the inclusion of periodic adjustment processes which might reset the log price or the adjustment mechanisms.

The challenge for the parties who have transitioned to mill door sales is to demonstrate the enhanced return being achieved in return for an increased risk exposure. In simple terms, the party completing the mill door sales should receive an increase return. This return might be a margin being paid to compensate the risks in securing and oversighting the harvesting and haulage arrangement, rather than a simple recovery of 100% of costs. For example, the cost incurred for an increase in working capital should be provided to the forest owner where completing mill door sales.

In many cases around Australia, the capacity to secure this margin on the increased pass through of cost is difficult in bi-lateral negotiations, both in the short and long term. This occurs as the bi-lateral arrangements commonly are seeking to enhance the efficiency of this function, and both parties seek to avoid identifying additional or new costs in the process.

This has resulted in many forest owners looking to the key enhancement to their returns is to secure enhanced value recovery due to their control of the delivery arrangement. This enhanced value recovery should result in higher overall stumpages arising for each harvesting operation, where logs are being delivered to the most optimal customer and their respective price.

In respect to the period from FY2014-2016, FCNSW appear to have recovered the third party costs incurred to harvesting and haulage contractors, and a stumpage, but not a margin in excess of these third party costs. Beyond a margin return to FNCSW for mill door sales, information on changes to enhanced value recovery between mill door and stumpage sales are commonly difficult to confirm, as development of a counterfactual of a stumpage sale value recovery outcome is influenced by a wide suite of factors. These factors include an assumed level of supervision of log grade allocations within the forest harvesting, the impact of changing competition for logs as observed in economic cycles and in forest regions where market access materially changes such as an expansion or closure of a wood processing facility; and the degree of complexity in the supply chain and the potential of changed behaviour of harvesting and haulage contractors in the event control of this activity moves from the forest owner to the log buyer. FCNSW continue to supply a wide suite of log species and grades to a wide range of customers, and with wide spread of customer sizes and log requirements. This supply is done through a mix of sales arrangements, mill door, and stumpage plus delivery costs which FCNSW use to manage their risks.

7. FINDINGS AND RECOMMENDATIONS

7.1 Findings

Our overall findings from the review undertaken for this report are the following:

Benchmarking

- *Harvest rates* - given the different operating and commercial environments, harvesting operations display high degrees of customisation both within FCNSW operations and in contrast to other jurisdictions. Given this, it has proven difficult to compare FCNSW harvesting rates to other markets and inter-jurisdictional data has provided directional guidance. Whilst the observed rates in the four identified geographic markets in which FCNSW procures harvesting services appear higher than other jurisdictions, there are market specific factors influencing operating costs that can be attributed to the higher harvest rates in NSW. We do note that the harvest rates over the three years covered by this review have increased at a lower rate than the CPI over the relevant period, and that rates across the regions of NSW are comparable;
- *Haulage rates* – haulage operations have been easier to benchmark given haulage operations are more comparable across jurisdictions. Based on the available data our findings are that FCNSW's haulage costs are within the ranges observed across comparable operations.

Market Power Assessment

The activity and trend data in relation to the number of operators participating in FCNSW's procurement processes indicate a level of contestability for the provision of harvest and haulage services in the markets identified. To consider whether there may be market power within local or regional markets for harvest and haulage services we have considered the following:

- The trends in market concentration for the provision of harvest and haulage services in the identified geographic markets;
- The current market structure and basis on which harvest and haulages services are procured by FCNSW; and
- Pricing for harvest and haulage services over the three year period considered for this review.

Based on the available data and information in relation to these three areas, it would appear that the market for the provision of harvest and haulage services in the identified geographic markets result from a contestable process and that the market concentration and pricing outcomes over the three year period covered by the review do not appear to highlight potential market power in local or regional markets.

Cost Recovery

FCNSW delivery charges appear to be commensurate with third party contracted costs over the three year period overall, however from the data available, only a minor part of the administration cost is recovered from the delivery charge.

Indufor and FCNSW have estimated the marginal costs of managing mill door sales, purely on the basis of the attribution of FTE positions. The derived cost appears to be reasonable on a volumetric basis in comparison to industry benchmarks.

Summary of findings

FCNSW costs for harvesting services are higher than that evident from inter-jurisdictional operations, however appear to be reasonable on the basis that;

- Increases are largely less than CPI over the review period
- Operating conditions are significantly different within and between the jurisdictions, and appear to explain a significant proportion of the higher costs in NSW
- The market appears to be reasonably competitive and FCNSW are actively managing procurement processes to seek price discovery and ensure contracted parties are operating efficiently.

FCNSW costs for haulage services are commensurate with other native forest operations.

FCNSW administration costs appear to be commensurate with comparable operations. From the data provided, FCNSW do not appear to be fully recovering both contract and administration costs through the application of delivery charges.

7.2 Recommendations

Based on our findings above, our recommendations on the options for enhancing the capacity for FCNSW to benchmarking its harvest and haulage costs are the following:

- ***Procurement processes –*** FCNSW consider the development of a systematic and consistent approach to the collection and reporting of data and information in relation to its procurement of harvest and haulage services including: tender details, tender specification, bidder participation and contracts awarded (including rates). This could involve a summary table from tendered or negotiated outcomes that could directly inform an analysis of the functioning of the market.
- ***Cost data –*** FCNSW work towards the development of standardised cost data set for its harvest and haul operations by: contract, product, market, price and volume as suggested in Appendix C;
- ***Alternative approaches -*** FCNSW consider capturing additional data that may support the development of alternative approaches to benchmarking such as data on inputs and outputs of harvesting and haulage.
- ***Inter-jurisdictional data –*** FCNSW further examine the feasibility and value of collecting additional data from other jurisdictions to provide the basis for the development of other benchmarking techniques such as productivity indexes in the future; and
- ***Cost recovery –*** FCNSW give consideration to ensuring the financial monitoring and reporting systems appropriately capture costs and revenues associated with managing mill door sales

to ensure that future comparisons with cost recovery and the administration burden of alternative sales arrangements can be made.

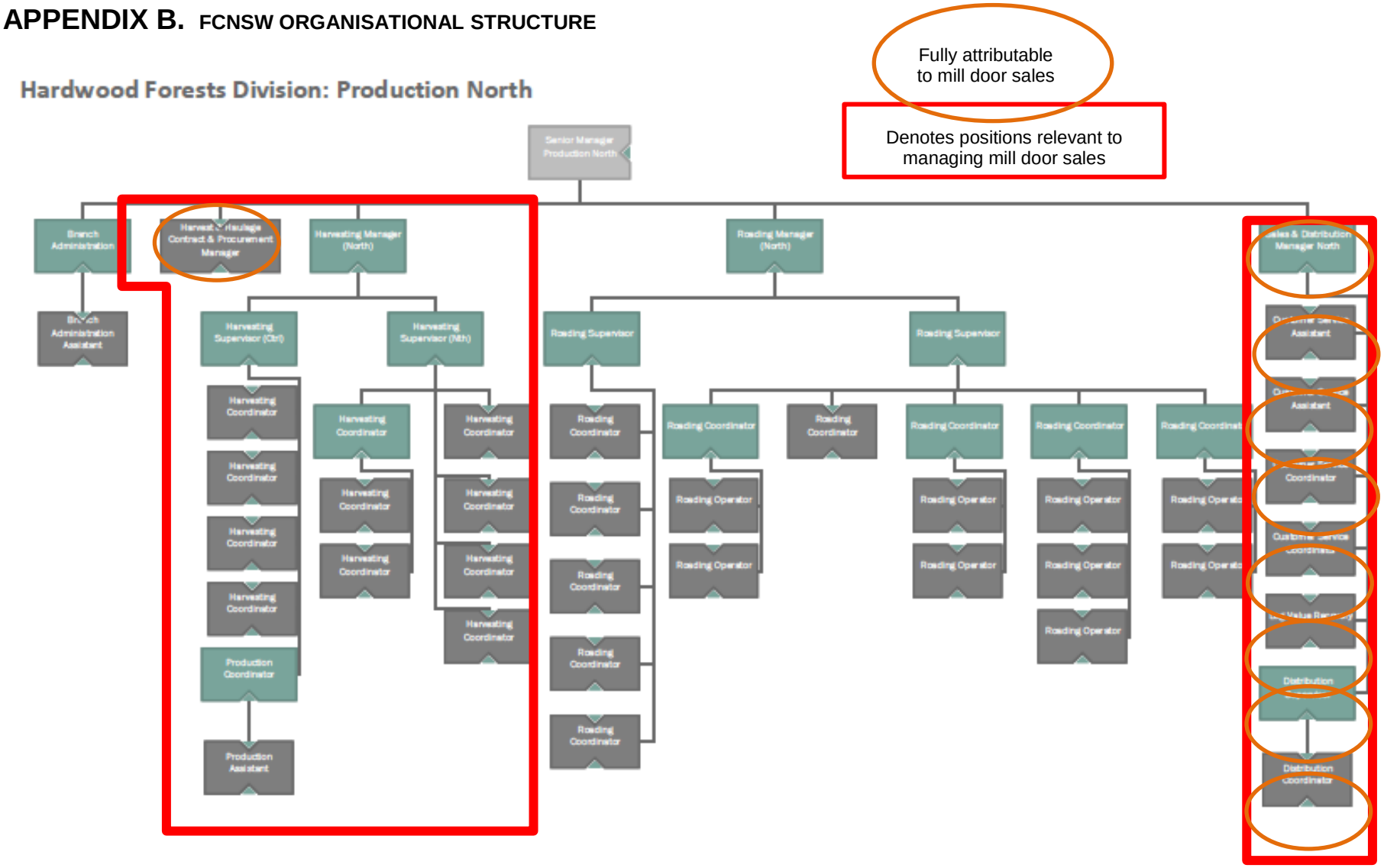
8. BIBLIOGRAPHY

Ghebremichael, A.; Nanang, D.M. 2004. Inter-regional comparative measures of productivity in the Canadian timber harvesting industry: a multilateral index procedure. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. OR-X-391.

APPENDIX A. EXAMPLE MANDATORY EQUIPMENT REQUIREMENTS

Equipment	Mandatory Equipment Specification
Harvesting equipment	Protective guards and structures on heavy mobile plant – ROPS, FOPS and OPG (see attached circular CEC 201403 Protective Structures on Heavy Plant) Mechanical harvesters and processors (as a minimum) must be fitted with an appropriate fire suppression system that meets Australian Standards AS5062.
Prime Mover	Truck mounted UHF two way radio. UHF hand held radio. Central tyre inflation (CTI) on the drive wheels or another system that the contractor can demonstrate provides comparable benefits to the satisfaction of FCNSW. A cabin rear guard system manufactured to a standard to protect truck occupants in the event of load shift. On-board scales with a remote readout to allow load measurement to an accuracy of +/- 100 kg while the Driver is outside the truck in the safe zone. Global Positioning System (GPS) as specified in clause 14.2 Smart Phone if requested by FCNSW Firefighting equipment as per the Forest Practices Code
Trailer(s)	On-board scales with a remote readout to allow load measurement to an accuracy of +/- 100 kg while the Driver is outside the truck in the safe zone. Airbag suspension or another system that the contractor can demonstrate provides comparable benefits to the satisfaction of FCNSW. Automatic load tensioning system on all bays Remote release straps such that the loads can be unsecured by remaining on the Driver's side of the Vehicle. 1800 LOGHAUL signage indicating the Vehicle's designated fleet number and of the following dimensions.(859X258mm) Electronic Braking System that incorporates rollover protection and is capable of recording brake pressure, time, faults, and EBS triggers.* Light Emitting Diodes (LED) lights on brake, tail and indicator, and clearance lights. A design aimed at improving Vehicle stability.
Vehicle combination (prime mover and trailer)	All components of the combination (i.e. trailer(s) and prime mover) must individually exceed a Static Roll-over Threshold (SRT) of 0.35g at all times.
Office/Home Base	Personal computer with internet connection and an email address.

APPENDIX B. FCNSW ORGANISATIONAL STRUCTURE



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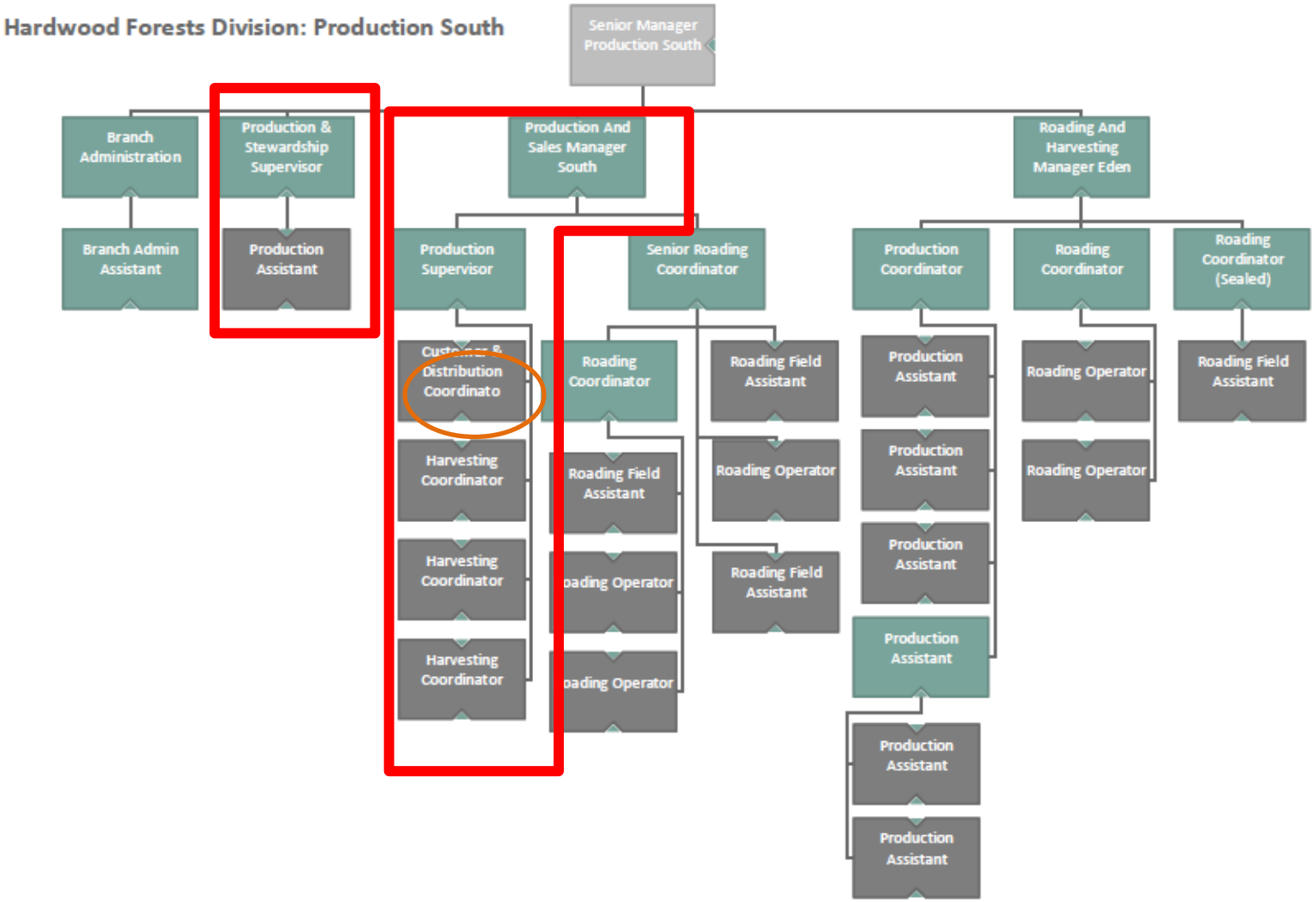
Hardwood Forests Division: Production South
Senior Manager Production South
Branch Administration
Production & Stewardship Supervisor
Production And Sales Manager South
Roading And Harvesting Manager Eden
Branch Admin Assistant
Production Assistant
Production Supervisor
Senior Roading Coordinator
Production Coordinator
Roading Coordinator
Roading Coordinator (Sealed)
Distribution Coordinato
Roading Coordinator
Roading Field Assistant
Production Assistant
Roading Operator
Roading Field Assistant
Harvesting Coordinator
Roading Field Assistant
Roading Operator
Production Assistant
Roading Operator
Roading Field Assistant
Harvesting Coordinator
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Production Assistant
Harvesting Coordinator
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Production Assistant
Production Assistant
Production Assistant

APPENDIX C. PROPOSED DATA REQUIREMENTS

Source	Data required	Used to calculate and compare
Load data from sales system	Date	Unit cost comparison 2013 – 2016, 2016 – 2019 Changes in operating conditions Changes in market share / operation
	Tonnes and m3	
	Product and Customer	
	Contractor and crew (if available)	
	Transport distance by road class	
	Actual $ for Harvest, haul, delivery, other (payment), other (revenue)	
	Harvest Plan ID	
	Region, Price zone	
	Difficulty class	
	Truck type	
	Yield per ha x harvest plan ID	
	Average slope harvested (data from DTM preferred)	
	Snig distance data (if available)	
	Rate schedules for harvest and haul	
	Fleet performance – average lead, loaded km, utilisation	
Other jurisdictions	Average harvest cost by contractor x volume harvested	Rate changes over time and impact of operating parameters on costs
	Average haul rate by contractor x volume x distance, haul rate schedules	
	Harvest costs by yield, slope and other operating parameters if available	
Tender reports, negotiated outcomes, briefing notes,	Specifications, candidate market, participants, rate outcomes	Activity in market and degree with which it is operating effectively

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