



PRIMARY GROWTH PARTNERSHIP BUSINESS CASE

**Te Mahi Ngahere i te Ao Hurihuri –
Forestry Work in the Modern Age**



Summary of Business Case

23 February 2018

1. Introduction

This new Primary Growth Partnership (PGP) programme “Te Mahi Ngahere i te Ao Hurihuri – Forestry Work in the Modern Age” has three major aims: to create value, improve profitability and enhance sustainability across the forestry value chain through automation. It aims to do this by developing a new integrated forestry value chain from harvest to market, incorporating new technologies that will promote both industry and Government interests.

1.1. Vision

The vision is “No boots on the ground, no hands on the log”. It reflects the focus on new automation and robotics technology in the ever-changing world (*te Ao Hurihuri*). The programme develops a revolutionary change to the forestry value chain that will effectively redesign the harvesting and log manufacturing, processing and logistics process. But the concept isn’t solely about change, it encapsulates the idea of people as the constant core that act as an anchor to the change occurring across the industry.

The programme is led by the Forest Value Chain Consortium, a partnership of forestry companies, harvesting and logistics contractors, and machinery manufacturing firms. It builds on the successful development of forestry mechanisation, remote control and teleoperation developed in the earlier PGP Steepland Harvesting programme.

To achieve this vision the Consortium proposes development of relocatable centralised robotic log sort yards as a total wood logistics solution. The goal is that by 2030, over 20% of all harvesting operations will be fully automated, using products developed in this programme. Our plan proposes initial development of five new log sort yards, in Waikato, King Country, Hawkes Bay, Manawatū-Whanganui, and the Wairarapa over the next seven years, which will handle over 2.8 million cubic metres (m³) per year supplied by 40 different harvesting crews.

1.2. The Value Proposition

Total investment over the seven years of this PGP programme, from co-investor cash and in-kind contributions, and from Ministry for Primary Industries (MPI) is \$29.36 million, excluding GST. For this investment, the programme will realise significant growth for the New Zealand forest industry by: supporting the harvest of small forest holdings across New Zealand; creating a more sophisticated and diverse workforce; a step change in labour productivity; increased safety; improved environmental outcomes; and providing new product opportunities.

The cumulative net economic benefits achieved by 2030 from forestry value chain efficiencies and sales of new machinery and equipment are \$395 million (\$100 million per year in 2030). If the new logistics solution was rolled out to the whole industry (excluding existing centralised log processing facilities), 55 log sort yards could be created, adding a further \$230 million of value to the industry per year.

This radical new wood logistics solution will address multiple goals:

1. Forestry value chain costs will be reduced
2. Labour shortages will be alleviated
3. Economic viability of harvesting small forests will be improved
4. Long term sector sustainability will be enhanced
5. New product opportunities will be created for domestic sale and export.

For the Consortium forestry companies that adopt this new supply chain the benefits will include:

- Lower forestry value chain costs from stump to customer by \$9.71 per cubic metre (12% of value chain costs), generating cumulative operational cost savings of \$338 million by 2030
- Increased labour productivity through smaller harvesting contractor crews. Average crew size will be able to be reduced by 50% (from 8 workers to 4), increasing labour productivity from 38 m³/worker-day to 65 m³/worker-day (+70%)
- The ability for increased forest harvest to be handled by the same size workforce, alleviating current labour shortages. There will be changes to the workforce with 190 new roles created using mechanised and automated harvesting technology. Active training and retraining programmes will be developed around future needs and the new systems

- Harvesting of small forests will be more viable economically, resulting in the expansion of the annual harvest to 35 million m³ per year
- Improved safety with a reduction in serious harm rates from 28 incidents p.a. in 2016 to less than 10 p.a. by 2025
- Smaller log landings (by 75% area) will reduce the annual volume of excavated soil during landing construction
- Less chemical fumigation, by 1.2 million m³ of export logs p.a., due to in-forest debarking
- Increased use of HPMV will result in 15,000 fewer truck trips on the public highway every year.

For the Consortium manufacturing partners the new forestry value chain will result in the development of eight new commercial products, with sales of over 1240 units of new equipment and machinery, generating cumulative gross sales margin of \$86 million by 2030.

Benefits for wider New Zealand will include improved economic viability of harvesting small forests, enabling the potential annual forest harvest to expand to over 35 million m³ per year, improved profitability of forestry to incentivise new forest planting, and improved public safety through increased use of High Productivity Motor Vehicles (HPMV), which have larger gross vehicle mass and will reduce the number of logging trucks on public highways.

2. Proposed Programme

This programme changes the way logs are processed and delivered to customers. It harvests, sorts and stores logs more efficiently and safely than current landing-based methods. The result is a move away from lower skilled labour towards total mechanisation and introduction of automation based on skilled labour. This programme brings together participants from the whole forestry value chain in a cooperative approach to change, in a systematic prioritised manner. This is a significant step for a sector where collaboration towards innovation has traditionally been difficult to achieve.

The programme is in two parts: firstly, automation of forest harvesting machinery and incorporation of new technology on the log landing (as well as new transport alternatives) – see Figure 1); and secondly, the total redesign of log sorting and handling processes at the robotic log sort yard (Figure 2). Greater use of HPMVs to move logs from sort yards to customers is also part of the programme.

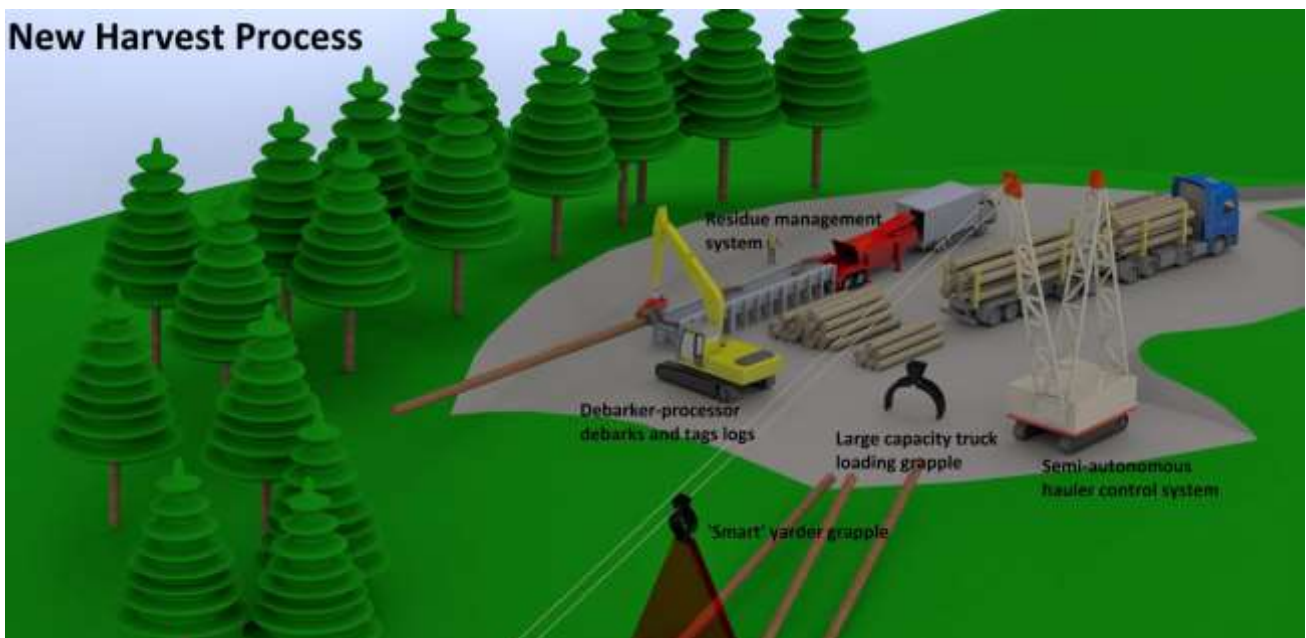


Figure 1: Improved on-landing harvesting processes

The new automated harvesting and logistics system (Figure 1) will eliminate hazardous manual tasks on the landing (such as log quality control, log branding, stocktaking, and truck load securing). Individual log identification and tagging will replace log branding and stocktaking and improve dataflow from production to customer. The improved processes

will extract more value from the forest resource through in-forest debarking and reduced log wastage through improved residue management.

A key difference to existing hauler operations is relocating log sorting to in-forest sort yards, (Figure 2) reducing machinery and space requirements on log landings and lowering overall costs. At the sort yard a new robotic log sorting facility will scan and sort mixed grade logs from the hauler log landings. A shape recognition log scanner will calculate true cubic volume (eliminating manual log measurement) and perform log quality control. Sorted logs will then be loaded to an automated truck loading gantry, which will halve the number of times logs are handled during the current log manufacturing process. The truck loading gantry will load HPMV in less than 10 minutes per load, down from over 40 minutes currently. These 58-tonne gross truck and trailer units will cart logs from the sort yard to the market (either domestic mill or port).

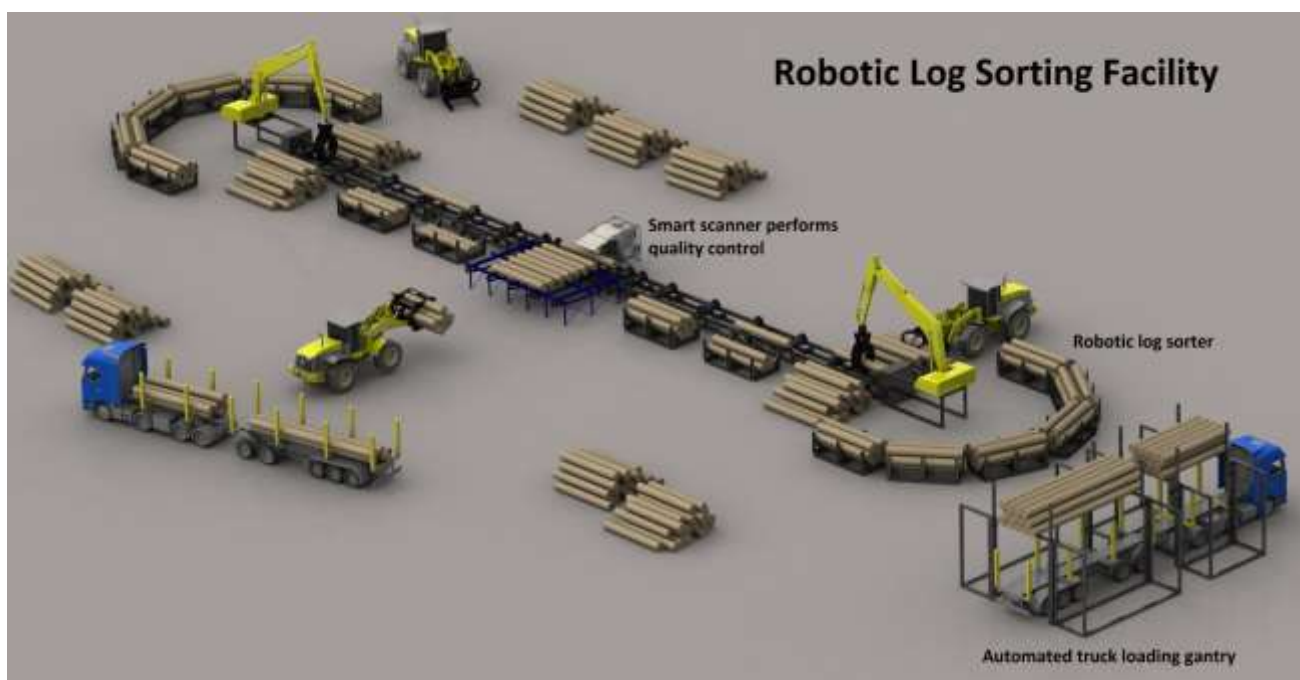


Figure 2: Improved log sorting, handling and loading processes

This will halve the number of times a log is handled during the manufacturing process, improve the flow of wood and information from forest to customer, reduce human exposure to risk and reduce costs. Implementation will require new systems with new functions and new products to be manufactured to deliver these innovations. The programme will achieve this by a close partnership model based around project teams comprising forest owners, contractors and the manufacturing developers.

An important innovation is to design the systems and products with the worker in mind. Designing the human-machine interface and minimising the impact on workers will be a cornerstone of the design process. Further, the programme has a major focus on developing the training required not only for the new systems but also for the future workforce.

The Forest Value Chain Consortium will lead the programme. The foundation members of the Consortium are a mix of large and small forest management companies, their key harvesting and logistics contractors, and the forestry equipment manufacturing partners. This Consortium has engaged Forest Growers Research Ltd (FGR) to manage the development and commercialisation programme. FGR, formerly Future Forests Research Ltd (FFR), is a private forestry innovation company made up of 29 member companies, and represents the interests of both Forest Grower Levy paying stakeholders and other investors in forest growing research.

The Consortium plans to establish five new logistics systems throughout the North Island, supplied by 40 harvesting crews. This will provide a reliable initial market for the manufacturers and reduce their market risk. The impact of these initial systems will be a potent demonstrator to the industry and will enable the participant individual companies to realise tangible benefits. As with the earlier Steepland Harvesting PGP, which catalysed increased mechanisation of harvesting, it is expected that this step change in logistics will catalyse widespread adoption of log sort yards.

2.1. Rationale for investment

The contribution of the Consortium forestry companies and their participating contractors to the programme is \$15.834 million, made up of \$6.795 million in cash from the Forest Grower Levy, \$7.255 million in co-investor cash from the first adopter Consortium forest owner/contractor(s), and \$1.784 million in-kind contributions from Consortium forest owners and contractors.

FGR and its associate members are also co-investors in this programme. The contribution of FGR associate members to this PGP programme is valued at \$0.113 million in cash. While this contribution is small in cash terms it is important in terms of engagement of a wide range of industry stakeholders.

The contribution of the Consortium manufacturers to the programme is valued at \$1.669 million in terms of design of the technology products (\$1.302 million in-kind contributions) and technical support during deployment (\$0.367 million in-kind contributions).

The final programme partner is MPI, whose proposed contribution is \$11.744 million (Table 1).

Table 1: Summary of Programme Investment by Co-investor

Investor	Total Funding (\$'000) excl. GST
<i>Forest Grower Levy</i>	6,795
<i>For.Co./Contractor cash</i>	7,255
<i>FGR cash</i>	113
Consortium cash total	14,163
<i>For.Co./Contractor in-kind</i>	1,784
<i>Manufacturers in-kind</i>	1,669
Consortium in-kind total	3,453
Consortium total	17,616 (60%)
MPI investment	11,744 (40%)
TOTAL INVESTMENT	29,360

Investment by various stakeholders in the forest industry and the Government not only motivates the collaborative nature of this programme (as Government support for change has a positive effect on industry uptake), but is also critical to the implementation of this radical new logistics solution.

The programme creates opportunities for a more coordinated approach across industry training and educational institutions to identify future training needs of the industry and develop the workforce of the future. This programme will collaborate with these training and educational institutions (such as Toi Ohomai Institute of Technology, University of Canterbury and the ITO Competenz) to undertake this task. In the absence of PGP funding, progress in this area will be slow.

The wider public benefits of the programme include improving safety and environmental outcomes through eliminating hazardous manual tasks, reducing soil disturbance with smaller log landings, and taking trucks off the road with increased use of HPMV. This will improve forestry's social license to operate, so the community sees that harvesting and log transport is a good safe and sustainable business and one that is looking after its people. The programme provides opportunities for labour productivity improvements and vital social, environmental and regional development benefits, which would be foregone without this coordinated "whole of value chain" approach. This change cannot be achieved, and the automation innovations implemented, in a piecemeal manner.

The first adopters of this new design will incur significant costs and risks which subsequent implementers will not face. The extent of the change and the upfront costs and risk means that the planned changes are unlikely to happen without the combination of PGP and industry funding. With no PGP investment these developments would not go

ahead as designed. Because of the interdependencies between the planned projects, a large scale programme is required to generate the significant benefits forecast (over \$100 million per year by 2030). That is, because this development requires a complete system change it is largely an “all or nothing” initiative.

The most immediate consequence if this programme does not happen will be the heightened risk of lack of profitability and consequent harvest of the small-scale forest resource. With current costs and prices, increased harvesting costs of \$10/m³ (equivalent to the operational cost savings delivered by this programme) could result in 9-11% more of the small forest resource becoming uneconomic to harvest than is currently forecast. In 2025 this could amount to 1.65 million m³ per year that may not be harvested. The reduced economic activity is likely to be in excess of \$190m p.a. by 2025.

The combined consequences of not addressing both the supply chain issues as proposed, and the future training needs of the market, will continue to constrain industry growth, risking the increased harvest of the small forest estate (due to labour shortages and high costs). Long term, improving the attractiveness of forestry as a career for skilled workers using new technology will be essential to assisting the government achieve its ambitious forest planting programme, and climate change targets.

3. Benefits

3.1. Net direct economic benefits

The cumulative net economic benefits are \$395 million (\$100 million per year in 2030). Total economic benefits achieved within the programme timeframe (2025) from forestry value chain efficiencies and sales of new machinery and equipment are described in Table 2.

Table 2: Summary of Total Economic Benefits from programme to 2025

Benefit	Description of Cost / Benefit	Annual Benefit in 2025/26 (\$ million p.a.)	Cumulative Benefits to 2025/26 (\$ million)	Savings (\$/m ³)
Labour productivity from automation	Reduced harvesting cost from smaller automated crews	\$18.99	\$54.18	\$6.72
Value chain efficiencies	HPMV log cartage, elimination of log weighing and export log scaling	\$6.44	\$19.19	\$2.28
Environmental sustainability	Improved harvest planning, smaller log landings, improved residue management, and reduced chemical fumigation	\$2.02	\$7.45	\$0.71
Sub-Total	Operational Cost Savings	\$27.45	\$80.82	\$9.71
Machinery Sales	Gross margin on domestic sales of machinery and equipment	\$4.91	\$22.77	
Total Economic Benefits	Total	\$32.36	\$103.59	

A new forestry value chain will be created by 2025 with five new robotic log sort yard systems supplied by the initial 40 harvesting contract crews operating eight new automated products. This translates to an early adopter market of 312 units. Subsequent developments in the following five year period from 2025 to 2030 will see further sales of 930 units (576 units in 9 further log sort yards and additional component sales of 354 units). The total NZ market in 2030 could be up to 55 sort yards supplied by 440 harvesting contractors, which translates to a potential market of over 3,500 units. The international market for these technologies will be primarily North America, Chile and Australia. Collectively, these markets are at least five times the size of the New Zealand market.

By 2030:

- Annual operational cost savings from value chain efficiencies will have lifted from \$27.5 to \$76.8 million p.a.
- Cumulative harvesting and logistics operational cost savings by 2030 will increase from \$80.8 million to \$338.7 million.
- Commercialisation of 1242 units of machinery (14 log sort yards plus additional component machinery sales) is projected to increase annual gross margin on sales for the manufacturing partners from \$4.9 million p.a. to \$23.3 million p.a. This will result in cumulative gross margin on sales of \$86.2 million by 2030.
- Total cumulative economic benefits projected to 2030 that are directly attributable to the programme will be \$424.9 million, less programme costs of \$29.4 million, resulting in net economic benefits of \$395.5 million.

3.2. Sustainability benefits

- On-going social license to operate through improved safety by eliminating hazardous manual tasks will reduce health and safety incidents (and associated costs and liabilities). It is expected that the number of serious harm incidents in forestry and logging as recorded by WorkSafe NZ will be further reduced from 28 incidents p.a. in 2016 to less than 10 incidents p.a. by 2025.
- The industry's environmental performance will also be improved, and this will enable the community to see that harvesting and log transport is a good safe and sustainable business and one that is looking after its people.
- The programme will address labour shortages through automation and process changes within the forestry value chain. Outcomes will be a reduction in overall labour demand and increased labour productivity. By creating lower physical workload jobs, with improved safety through automation, the sector will become more attractive as a career to a wider and more diverse base of employees.
- A strengthened manufacturing sector oriented to forestry equipment and resultant exports, ultimately far greater than the NZ market. Commercialisation of equipment will result in sales and generate gross margin for the manufacturing sector and future-proof the industry's move into new automated technology.
- The programme brings together participants in a more integrated systems approach to innovation which will increase the uptake and use of technology and improve the sector's competitiveness.

3.3. Spillover benefits

- The value to the economy by 2025 of enabling the harvesting of forests that otherwise would not be economic to harvest is \$190 million p.a. It is anticipated that a large proportion of the small scale forest resource will be marketed through harvesting and marketing companies, such as Consortium members PF Olsen Ltd, Rayonier Matariki Forests, Forest Enterprises Ltd, Forest Owner Marketing Services Ltd and Wood Marketing Services Ltd. In this way the benefits of this technology development programme will be extended to small scale forest owners.
- Adding value to domestic wood processing sector by addressing log supply and quality issues in some regions through the centralisation of log volume at in-forest sort yards, improved log manufacturing and individual log identification.
- Improved regional resilience. This programme will actively contribute to the economic well-being and sustainability of rural communities. It will increase employment opportunities and potentially attract workers back into these communities.
- Improved profitability makes new planting more attractive, which helps government achieve its objectives of more trees planted.