

This final report summarises the progress made against the strategic goals, project objectives, key findings and lists potential next steps and recommendations.

Tōtara Industry Pilot project

Final summary report

V2.1 August 2020

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Final summary report: Tōtara Industry Pilot project

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Approvals

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Table of Contents

Executive Summary	7
Key Findings.....	7
Remaining gaps, risks and issues.....	9
Next steps and Recommendations	10
Results from the Pilot Project	11
Background	13
Strategic Intent and Kaupapa.....	13
Project results by objective	14
Forest	16
Key Findings: Forest	20
Sawing and Drying	22
Key Findings: Sawing and Drying	24
Market and Brand story development	25
Key Findings: Market and Brand development	31
Enabling Environments	32
Key Findings: Licence to Operate	34
Evaluation of operational financial viability	34
Business advice and proposed models	41
Key findings: Financial and Business models	44
National context for indigenous forestry.....	45
Issues and risks.....	47
Next steps and Recommendations	50
Operations of the Pilot Project	52
Finances	52
Communications	54
Kaupapa in practice	56
Key learnings and critical success factors	57
Appendices	58
Appendix 1: Deliverables summary	58
Appendix 2: Tree form criteria.....	60
Appendix 3: Grade recovery data from pre-pilot, first and second project harvests.....	61
Appendix 4: Technical risk heat maps at start (June 2018) after revision (Nov 2018) and after Stage 2 operations (Sept 2019).....	62
Appendix 5: List of publications and media coverage on the TIP project.....	64

Figures

Figure 1. Value to New Zealand by year of operation and market strategy	7, 40
Figure 2. Work streams of project with key risks and outcomes.....	12
Figure 3. Projected timber volumes per year over a thirty-year operation	35
Figure 4. Diagram of proposed business model (by Spring, 2020).....	43
Figure 5. Risk Heat map - September 2019 to February 2020	48
Figure 6. Narrative of Risk Heat map - September 2019 to February 2020	49
Figure 7. Risk Heat map - July 2018	49

Tables

Table 1. Dressed volume recovery (m ³) by grade and dimension of the first TIP harvest.....	23
Table 2. Dressed volume recovery (m ³) from the second project harvest (Stage 2)	24
Table 3. Financial model results (net present value – NPV and internal rate of return – IRR) with a range of scenarios that vary log volume, discount rate, weighted wholesale timber value and other operational conditions	38
Table 4. Financial report for TIP project life	53

Illustrations

Illustration 1: Pre-harvest karakia by Kaumatua Edwards Beattie, Ngāti Hine; Felling of selected tōtara on a farm site near Kaeo; Loading tōtara logs to be sent for milling in Rotorua (May 2018)	18
Illustration 2: Assessing heartwood content at Toi Ohomai training mill site; Logs going through sawmill; Tōtara boards after grading prior to drying (June 2018)	22
Illustration 3: Samuel Marsden Memorial Church at Matauri Bay. Floor replacement from chipboard (before) to farm-tōtara (after) from a farm site nearby	27
Illustration 4: Demonstration stand (two sides) with interior products of wall panelling and flooring, and exterior products of weatherboards and decking. Lyonel Grant forming laminated carving structure for the waka carving, the carving in progress and the completed carving being installed	28
Illustration 5: Decking trial on installation and after 12 months exposure	29

Kaupapa

Te Pae Tawhiti or Vision

“He tōtara tuturu - He iwi tū tonu

Sturdy tōtara - Sustainable communities”

Te Kaupapa or Mission

“Kei te tohunga te whakaaro

The carver brings the wood to life”

Nga Tikanga or Values

❖ Keteriki

Everyone has a role to play

❖ Pukepukerau

Protect and convey our unique stories

❖ Kaitiakitanga

Uphold sustainability

❖ Tuturu

Maintain a culture of authenticity

❖ Rangatiratanga

Self-determining communities

Nga Whaingā Matua – Our Key Strategic Goals

- ❖ To create a sustainable and appropriate land-use industry
- ❖ To build scale through collectivising our resources
- ❖ To generate and retain wealth in our region and respective communities
- ❖ To establish our brand and provenance stories
- ❖ To foster opportunities that build capacity, capability and participation

Executive Summary

The purpose of Tōtara Industry Pilot (TIP) was to test the economic and environmental viability of an industry based on naturally regenerating tōtara on private and Māori land in Northland. The Tōtara Industry Pilot started in April 2018 and was formed out of a rich history of partners working on smaller Northland tōtara-focused projects. The project partners formed the TIP Steering Group whom then had responsibilities for the project.

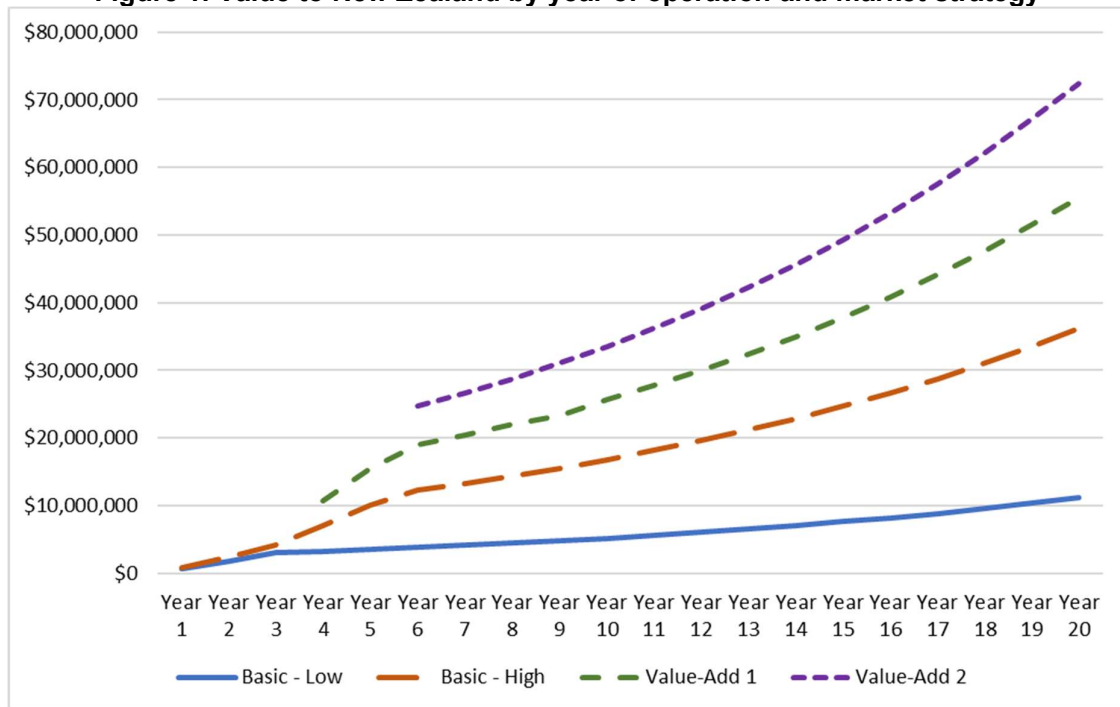
The Tōtara Industry Pilot developed an overall strategic intent (kaupapa) that was framed within Te Taitokerau Māori world view. The kaupapa informed how project objectives were achieved and the decision-making processes.

Key Findings

The project finds that **there are sustainable and viable business opportunities** based on sustainable and ecological management of farm-based naturally regenerating tōtara.

The project estimates the total value to New Zealand after ten years is between \$5.1 million revenue pa (worse-case scenario with basic NZ strategy only) and a high-value case of \$37.7 million revenue pa (value-added option 2) as shown in the Figure 1 below, growing over time.

Figure 1. Value to New Zealand by year of operation and market strategy



Key:

- Basic - Low uses the lowest weighted average for manufactured product (estimated \$2200/m³ retail), the lowest volume (no changes to tree growth rate, MAI of 1m³/ha/year), no value added
- Basic - High uses the higher weighted average (\$3000/m³ retail), the higher timber volume (tree growth rate increase to MAI 3.1), no value added.
- Value Add 1 uses higher timber volume and weighted average with 50% basic strategy and 50% value-add of medium value (\$6200/m³ retail)
- Value added 2 uses same as 1 for basic strategy but at 75% of timber volume, with 25% value-add of 5 times value per volume (\$15,000/m³ retail, the higher of the value-added options)

The opportunity has greater potential that is contingent on changes to how the allowable harvest rate (tree volume) is calculated (Basic – High in Figure 1) and on allowing kitset or fully manufactured native timber products to be exported and a carving timber market in the value-added cases (Value-Add 1 and 2 scenarios in Figure 1).

Key Risks Addressed

This project addressed key risks identified across the supply chain. Many of the identified risks have been mitigated, with the harvest and processing trials yielding positive results. The project results indicate that a **viable business opportunity** exists based on the **sustainable management of regenerating tōtara** on private and Māori land in Te Taitokerau Northland (also called “farm-tōtara”). There are some residual risks or gaps that remain, and these are outlined further below.

Highlights and key results:

- **Sufficient resource for small industry.** There is sufficient farm-tōtara on private and Māori land in Northland to sustain a small industry for the first 10 years. There is a greater resource of younger trees (<50-year-old) that will grow over time to merchantable size and add to the available resource. This natural increase and improved growth rates from management will see a significant increase in the available potential resource in the future.
- **Sustainable management demonstrated with farm-tōtara using single-tree extraction.** The project demonstrated that continuous-cover forest management and low-impact harvesting can be applied successfully to farm-tōtara stands.
- **Good grade recoveries obtained from poorer class trees.** The grade recoveries in the middle to upper grades was high, increasing value per volume. Two stages of project harvests were conducted on 3 properties and comprised a total of nearly 300 m³ (standing tree volume), from a wide range of tree classes (1-5).
- **Able to process in an existing (radiata) commercial sawmill.** Tōtara logs were successfully sawn through a commercial scale sawmill, with promising log to lumber recovery (>55%).
- **Able to kiln-dry.** Tōtara boards (25 mm) were successfully kiln-dried from green (freshly milled) at commercial scale, with thicker tōtara boards (50 mm) successfully kiln-dried at laboratory scale.
- **There is a market for high value tōtara timber.** Tōtara timber sold with positive feedback, with more sales to come (sales were interrupted by the Covid-19 pandemic restrictions).
- **Viable and sustainable business opportunity.** All the evidence collated and financial model results indicate that this is a viable business proposition. It is likely to be of smaller scale in the beginning than originally anticipated and of slower growth to ensure long-term sustainability.
- There was no/limited adverse reaction to harvesting native trees for commercial purposes.
- **Financially viable operationally.** The operational financial model revised with data from this project found that the both conservative and optimistic timber volume projections are financially viable at different scales of impact within the region. The wholesale value per volume increased from \$1866/m³ weighted average up to \$2200/m³. This model will be a valuable tool for future assessments of the impact of operational changes.
- **Value-added product opportunities explored.** The high-level market scan identified two key value-added product opportunities: decorative linings for wall and ceilings panels, and carvings.
 - Two preliminary business cases for each value-added product option have been developed. The business cases recommend business structures across the value chain and present road maps of key steps to establish each opportunity.
 - There is a high-level market-based financial model from this work that can be used as a tool to assess product mixes and targeting of different markets.
- **Stakeholder briefings.** Two series of stakeholder briefings were held in the latter part of the project: Community and Māori, led by expert facilitators. The response for the community briefings was largely positive with many offers of practical support. Key topics of

interest were wide-ranging and included: details of the tōtara resource, the Forest Act and permitting process, value for the landowners, scale of project and future proposed operations, and the proposed business model and financials. Māori briefings were conducted remotely by rohe and found strong interest from Māori to be involved and lead the next phase. Topics of discussions were kaupapa and tikanga practices within the Pilot and how these could be further developed, along with similar topics to the community briefings.

- **Website developed** to provide one source of project information and updates with consultation and enquiry channels (<https://www.totaraindustry.co.nz/>).

Remaining gaps, risks and issues

- **Residual resource risk.** There is still some variation and uncertainty in the estimations of the farm-tōtara resource available in Northland. It is difficult to obtain accurate inventories of merchantable tōtara volumes within stands as associated estimate errors can be high (near 40%), even after conducting extensive sampling of a specific area. The land area that contains tōtara-dominant stands with merchantable-sized trees on private and Māori land has been estimated to be around 26,500 ha.
 - The above figure is a subset of the proposal's estimation of 200,000 ha of indigenous vegetation cover on private land that contains tōtara *at various stocking rates*¹.
 - The impact of the reduction has been partially mitigated by positive changes such as log to lumber and grade recoveries.
- **Land owner engagement** will be a crucial on-going activity to ensure the success of the future operation. Co-ordinating and managing the collective resource spread over many hundreds of properties will be necessary and needs to be a key part of the next phase.
- **Permitting and planning processes and limitations**
 - The Forest Act applies, and the length of time and costs of the permitting and planning processes are significant, and improvements are highly desirable. Nevertheless, it is possible to work with the current provisions of the Act.
 - The industry's prospects are vulnerable to changes in legislation and regulation by government and local authorities. Submissions to protect and represent the interests of a future tōtara industry will be important in any review processes/opportunities.
 - Tōtara plantations could supplement supply in the future and avoid some of the current constraints.
- **Export issues** for manufactured products that require installation (e.g. wall & ceiling panelling). Export of such manufactured products are not permitted under the Forest Act. The current legal interpretation precludes the export of native timber kit-set or fully manufactured products where there is further cutting to size during installation.
- **Community engagement.** There will be an on-going need to engage with the community and more widely in NZ for the initiative and the future commercial entity.
- **Market development** requires long timeframes from initial interest to placement of orders (typically 12-18 months). More active promotion and positioning will be needed to sell the projected volumes of timber.
- **Other products and value.** There is potential value from the seeds, fruit, bark and other non-timber materials of the removed trees. Another product stream for tōtara waste heartwood is bio-extracts, such as essential oils. Supply chain and revenue streams haven't been explored under this project, but further investigation is highly recommended. Complementary research projects² indicate potential worth exploring in these areas.
- **Operational logistics to address.** There are many technical findings of how to more optimally operate and practice continuous cover forest management and the processing of

¹ Much of this area will also contain regenerating tōtara and have potential for management through natural forest successional processes to diverse native forest cover.

² Heubeck. S.; Harvest of PBR biomass Milestone report for MPI SFF405601 May 2020 (the Productive Riparian Buffer project) NIWA.

native logs. These include specialist machinery, harvest windows and conditions, and processing logistics. Implementing these findings confirm the need for a slower start-up.

- **Competition for the resource and the market.** There are other players already active in harvesting trees, approaching landowners and selling tōtara, albeit on a smaller and more ad hoc basis. This is a risk of direct competition and for the reputation of the industry if less than best management practice is not applied (e.g. taking more of the better class trees). However, this also presents an opportunity to work together and build scale in the region and more widely in New Zealand with others of like-mind.

Next steps and Recommendations

The next phase for TIP (pre-commercial). Due to the positive results of the current project, this opportunity should be pursued. There needs to be a final phase before commercial operations will be able to start:

- **Key business partners.** We need to identify and bring together key business partners and potential investors. This will include landowners, timber processors and potential manufacturers within Northland and more widely in New Zealand.
 - Wananga/hui are proposed with interested parties to progress the kaupapa and discuss tikanga aspects.
- **Secure funding** for this next phase as a matter of urgency. Options are MPI's Sustainable Food & Fibre Futures Fund, MBIE (Māori Innovation Fund – Commercial Advisers scheme), PGF II (Whenua Māori) or direct investment from potential owners.
- **Detailed business plans:** This will include scoping the key aspects of the business venture and producing detailed business plans for the selected product opportunities.
- **Agree strategy and implement plans.** With the engaged business partners, the business structures will then be formed, and the business plans implemented.
- **Continue to mitigate some of the remaining risk** such as market demand, landowner engagement and increasing legal license to operate.

Results from the Pilot Project

The purpose of the two-year pilot project was to establish whether the creation of a tōtara wood products industry in Northland is viable in practice and if so, the size of the opportunity and how it can be realised. The Pilot involves the harvesting and processing of up to 500 m³ of tōtara (log volume) and the market testing of farm-tōtara timber products at a commercial scale.

The key objectives of the pilot were to:

- quantify the availability and characteristics of the resource in order to test security around supply continuity;
- determine where costs are incurred throughout the supply chain and develop processes to reduce these;
- create an enabling environment for a future industry by developing an appropriate business/industry model and establishing a social and legal licence to operate; and
- develop the product mix and associated channels to market tōtara timber products.

On completion of the Pilot, a functional supply-chain has been explored, timber sold, markets 'seeded' and some continuity of timber supply arranged to enable a continuation following the successful completion of the Project.

Project outcomes:

1. De-risk the key processes along the harvest to customer value chain through prototyping each step.
2. Complete market validation for the domestic and a key export market.
3. Establish the best operational/manufacturing model for a business to exploit this opportunity to enhance social and community outcomes.






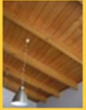







The activities, results and key findings are given by work stream: Forest, Sawing and Drying, then Market and Brand development, Enabling Environments (Licence to Operate) and finally Analysis, Financial and Business models (illustrated in Figure 2).

Key findings are summarised, along with remaining gaps identified, and the issues and risks that were identified, managed and mitigated during the project. Then the next steps and recommendations are given.

Learnings from the operation of the Pilot are given in the final part of the report.

There are more details in technical, milestone and business advice reports which form the Intellectual Property and know-how generated during this project. Some of this data has already been published and/or given as project updates on the project website (see <https://www.totaraindustry.co.nz/>).

Figure 2. Work streams of project with key risks and outcomes

	Forest	Sawing	Drying	Market	Licence to Operate	Analysis, Models, Project management
		 	 	 		
Key gaps addressed	Resource description and availability	Log and Grade recoveries, costs from sawing	Kiln drying schedules for tōtara boards	Market seeded, demand & price point assessed	Acceptance of use of native timbers	
Key risks mitigated						
Key outcomes	Verification of supply	Grade & volume recoveries	New drying schedules	Accurate price points, Pilot product range	Community and regulatory acceptance	Cooperative model, investment case

Background

The Northland tōtara initiative has been formally running since 2014 when several current partners came together to run several small projects in collaboration. Partners were active before this in separate projects and research tasks. The small projects undertaken together were:

- A high-level overview of naturally regenerated kauri and tōtara capacity, use, and general applications in the New Zealand market undertaken by Locus Research in 2014 (preliminary market assessment)
- A financial model of the potential business opportunity undertaken by PricewaterhouseCoopers (PwC) in 2015
- A small trial in harvesting and sawing of farm-tōtara (40 m³ standing tree volume), which was called the pre-pilot study, in 2017. The timber was air-dried in a closed shed.

Over time, more partners joined the initiative and the Steering Group structure was formalised for this current project, the Tōtara Industry Pilot (TIP) project, a two-year project addressing risks and gaps identified in the previous work. This project formally started on 19 April 2018, ahead of some of the agreed funding being contracted.

The current partners, along with representatives who sit on the Steering Group, are:

- **Tane's Tree Trust**, with Peter Berg and Paul Quinlan (also representing the Northland Tōtara Working Group)
- **Te Taitokerau Māori Forestry Inc**, with Pita Tipene and Rawson Wright
- **Northland Inc** with Vaughan Cooper and Codie McIntyre (currently; formerly also involved David Wilson till March 2019)
- **Te Uru Rākau** (within Ministry for Primary Industries), with Mark Hollis and Cathy Stephenson (from November 2018 to December 2019) and Marina Hetaraka (from December 2019 to August 2020), as TUR contract manager and SG observer
- **Scion** with Hemi Rolleston (previously Russell Burton to August 2018 and Julian Elder to March 2019) with Ramona Radford as observer
- Bruce Larsen of **Northpine** joined in September 2019 as the industry representative (a role sought from the start of this project).

A qualified project manager (Elizabeth Dunningham, Scion) was appointed by the Steering Group and started with the initiative in November 2017. It was agreed that Scion would be the fund holder and contracting entity for this project on behalf of the Tōtara Industry Pilot Steering Group (TIP SG).

Strategic Intent and Kaupapa

At the start of this project, a vision, mission (kaupapa), strategic goals and values were discussed and agreed to guide the operations of this project and long-term outcomes desired from the overall initiative, which would extend beyond the completion of this project.

Te Pae Tawhiti or Vision

“He tōtara tuturu - He iwi tū tonu / Sturdy tōtara - Sustainable communities”

Te Kaupapa or Mission

“Kei te tohunga te whakaaro / The carver brings the wood to life”

Nga Tikanga or Values

- ❖ Keteriki – Everyone has a role to play
- ❖ Pukepukerau – Protect and convey our unique stories
- ❖ Kaitiakitanga – Uphold sustainability

- ❖ Tuturu – Maintain a culture of authenticity
- ❖ Rangatiratanga – Self-determining communities

Nga Whaingā Matua – Our Key Goals

- ❖ To create a sustainable and appropriate land-use industry.
- ❖ To build scale through collectivising our resources.
- ❖ To generate and retain wealth in our region and respective communities.
- ❖ To establish our brand and provenance stories.
- ❖ To foster opportunities that build capacity, capability and participation

Tōtara is a taonga species to iwi but when Ngati Hine Forestry leader, Pita Tipene, communicated this whakatauki as the overarching mission for TIP, he qualified its meaning by saying the initiative is not about the wood, it's about people, tōtara will merely uncover the creativity, talent, skill, resources and inter-relationships that live in Northland people. Pita sees the collaboration as a long-awaited pathway for his people, it also represents the hopes of a wider regional community which looks forward to jobs, training, business and invitations to participate.

Project results by objective

The project results against specific objectives are summarised as follows:

Farm-tōtara resource in Northland:

Objective: quantify the availability and characteristics of the resource in order to test security around supply continuity.

- The initial region-wide assessment of tōtara resource availability in Northland was conducted by Indufor Ltd. using a sample-based approach.
- Results from this preliminary study indicated that 26,500 hectares of tōtara-dominant stands were present on private and Māori land (excluding public conservation land and private covenants).
- This land area would be sufficient to sustain a regional industry for the first 10 years of operation, under the current conditions and assumptions (up to 4,000 m³ logs).
- A more accurate assessment of the tōtara resource will not be possible until the LiDAR dataset for Northland region is available.

Costs of producing high quality tōtara timber:

Objective: determine where costs are incurred throughout the supply chain and develop processes to reduce these.

- We conducted two project harvests over 3 properties and averaged all costs of tree extraction and log making which gives an average log extraction cost under the one-off conditions of the project of \$150/m³ log volume. Stumpage (tree purchase) and transport costs from farm site to mill are additional to this.
- Other costs such as permitting/planning requirements, tree selection, landowner engagement and contract management were significant and also additional to these costs.
- Processing costs (sawing and kiln-drying) were calculated to be around \$300/m³ output dry timber volume.
- The operational financial model that was revised looked at options to reduce these costs such as hiring log-extraction crew as staff and purchasing specialist equipment rather than hire contractors on an ad hoc basis.
- Some options to reduce processing costs such as solar kilns have been discussed in general terms but not costed out. The feasibility of such options could be explored in the future.

- A thorough understanding of costs of production and recoverable timber volume and grades has been obtained. These data enable robust analysis and modelling of impacts of operational choices.

Enabling environments:

Objective: create an enabling environment for a future industry by developing an appropriate business/industry model and establishing a social and legal licence to operate

- The focus of work undertaken was on social licence to operate. One-to-one interviews, a public survey and selected stakeholder briefings were conducted to gauge interest, identify key questions and any opposition to the concept of developing an industry based on farm-tōtara. The stakeholder briefings were also conducted to raise general awareness of the project, objectives and progress.
- An informative website was set up, with a video, FAQs and a survey for feedback and comment.
- Feedback from stakeholder engagement has been largely positive. Very little adverse reaction emerged but some responses levels were not high in these engagement vehicles (e.g. the website survey).
- The main resistance is to cutting native trees down at all or to gain commercial value from such tree removals. These views are from those who are seeking to protect our native forests; an aim that we also seek to achieve with the best-practice ecologically sustainable management approach we applied and advocate.
- Establishing a long-term Social Licence to Operate will be an on-going task. Any future commercial entity will need to continue and expand upon the foundation started by this project.
- There is a constrained space for legal licence to operate. Our experience of operating within the current constraints of the Forest Act is included in the Forest work stream. While it is possible, the high compliance cost and current restrictions regarding conservative calculations of allowable volume present significant barriers.
- There is a recommendation for a resource-led business model through collective ownership to implement the future opportunity of a farm-tōtara product industry in Northland.

Market demand, performance and fit:

Objective: develop the product mix and associated channels to market tōtara timber products.

- Farm-tōtara applications were restricted to interior applications until the durability performance of the heartwood of these much younger trees has been evaluated.
- The product mix that has been targeted at higher value products such as wall panelling, ceiling sarking, other interior fit-out and joinery, as well as furniture, and decorative objects such as carvings.
- Timber merchant, JSC Timbers Ltd, were engaged to firstly provide initial market evaluation and then to sell the project timber to seed the selected markets and to provide feedback (such as fit to application and price point). Demonstration products have also been made to assess suitability and machinability, and provide examples of possible products.
- Feedback from clients and other users of the project's farm-tōtara has been positive, with the timber machining and processing well, taking glues and coatings with an attractive appearance.
- For interior products, linings such as wall panels and ceilings, as well as carvings and other decorative objects have been the key targets. There have also been requests for structural and exterior product applications, indicating some demand in these areas.

A table of the project deliverables from the proposal is given in Appendix 1, along with the results and outputs.

Forest

The Forest work stream was divided into two tasks: Resource and Harvest. This work stream covered the start of the value and supply chains; from the land, trees, extraction of logs, and includes consideration of environmental aspects such as water and soil conservation and any impacts on local flora and fauna.



A mosaic of young and semi-mature lowland-tōtara (*Podocarpus totara*) and grazed pasture is a feature of the landscape in several regions throughout New Zealand. These stands are at all stages of development and scale and have mainly arisen through human-induced disturbance, predominantly post-European settlement, involving bush

clearance and pastoral farming. Tōtara came back as a pioneer species and it is this local resource that can be managed for conservation and timber. The species is endemic to New Zealand and is found from sea-level to around 500-550 m elevation throughout the country. There are a number of other “tōtara” species found throughout NZ, and hybridisation does occur between the various members of the tōtara-family. This project has been focussed on better understanding the stand qualities and characteristics of predominantly lowland-tōtara, which we refer to as “farm-tōtara” in this report to make a clear point of difference to the old-growth tōtara that might be several hundred years old and has different characteristics such as a much greater size and more naturally durable heartwood content. Significant areas of regenerating tōtara on farmland can be found in other regions outside of Northland.

Resource

Resource assessment was a key task for this project, so that more accurate evaluation of the current farm-tōtara on private land could be made to verify supply. Another aspect of building a new industry based on this resource was to build confidence in supply for timber merchants, manufacturers and other end-users.

A preliminary resource assessment was conducted as contracted by Indufor. This piece of work was intended to validate the sampling methodology, from which the values of tōtara-dominant stands in Northland were extrapolated. The small number of plots sampled gave a conservative land area estimate of tōtara-dominant stands on private land available for possible harvest (26,500 ha). This is much lower than the figure used in the market report (in 2014) and in the original TIP proposal (200,000 ha), which is an estimation of the total native forest and shrubland area, *containing tōtara at various stocking rates* (as opposed to being tōtara-dominant), outside conservation estate and covenants. This has implications for the development of an industry based on farm-tōtara; in particular, the scale, rate of growth and timing of investment and profitability.

However, from this preliminary evaluation, there appears to be sufficient resource of farm-tōtara on private land in Northland to sustain a small viable industry that could utilise up to 4,000 m³ of log volume per year at the end of the first decade. Based on our projections, we expect that the annual log volume could be ~20,000 m³ at the end of the first thirty-year period. It is anticipated that these initial lower volumes would sustain the early years of an emerging industry. This conservative estimate of useable log volume per hectare per year is based on lower growth rates of senescent trees from old-growth forests, rather than more vigorously growing young

farm-tōtara. There is evidence of higher growth rates in these stands (e.g. 3.1 m³/ha/yr in lightly managed stands or 7.7 m³/ha/yr in thinned stands³), which may be sufficient to sustain the larger longer-term potential envisaged in the TIP Business case. However, the original assumptions in the initial business case and the inputs of the financial model used were revised from the data that emerged from the project (see operational financial viability section, p34).

Currently, the data that would enable an accurate and cost-effective assessment of the tōtara resource in Northland does not exist. The most promising solution for resolving this uncertainty is utilisation of remote sensing inventory techniques. It had been assumed that the LiDAR dataset for the Northland region would be available during this Project, but this was not the case. With this powerful dataset, most of the stand and landscape scale information about long-term resource availability could be obtained for low cost. In addition to a high-resolution digital elevation model, a LiDAR dataset could subsequently be used to create a canopy height model (CHM; i.e. height of the trees). A CHM coupled with a simple and extensive field sampling inventory would provide a more reliable estimate of volume that is currently available, and more so, it would provide the very useful spatially explicit information about the resource – areas of potential interest in the landscape could be easily identified based on the estimated growing stock of forest stands.

The shortcoming of the approach described above (i.e. airborne laser scanning) is that it will provide only very limited knowledge about the species composition. Hence, the actual quantity of tōtara within forest stands would have to be estimated based on the sample-based approach (e.g. ground truthing, oblique aerial imagery). This issue could probably be resolved by using multispectral or hyperspectral satellite imagery of a subsample of forest stands and quantifying the presence of tōtara (and other podocarps) in indigenous forest stands, if deemed necessary. All these approaches could be combined as part of a useful future study that would provide more accurate data and characterisation of the tōtara resource in Northland.

Despite these issues and taking a very conservative estimate of the available resource for harvesting, we believe that a case for establishing a new business harvesting tōtara in Northland still exists with the level of harvesting currently permitted by the Forest Act 1949. This is based on expected volume increments of the residual stands after harvesting, and the further development of the extensive younger stands with trees not yet of harvestable size but will grow to become available over time.

Tree harvesting

The harvesting of native trees was in accordance with the provisions under the Forests Act. These stipulate selection and extraction of single-stems or small groups (3-5 stems) of tōtara trees only, and with minimal disruption to the residual forest canopy and structure. This can be described as continuous-cover forest management practice. Further, this Pilot generally tried to implement a production-thinning approach to the selection of harvest trees (i.e. targeting trees with poorer form to the benefit of the remaining trees with potentially better long-term sawlog potential). This will ensure that the volumes harvested are replaced by growth from the residual forest and that the quality of the standing tōtara timber volume of the forests also improves over time.

The first project harvest was undertaken during May 2018 on one farm near Kaeo in Northland, with a karakia performed prior to the first tree being cut down. This harvest comprised of 75 trees (or 86 m³), a bit less than the targeted 100 m³ log volume. Tree classes 1-4 were taken with an average of 2.7. There was around 40% heartwood (by final board volume).

³ Quinlan, P; Bergin, M; Bergin, D and Kimberley, M 2014. "Management of naturally regenerating totara on farms – thinning and pruning" in *Planting and managing native trees* Technical article 11.3 (Tane's Tree Trust)



Illustration 1 (L to R): Pre-harvest karakia by Kaumatua Edwards Beattie, Ngāti Hine; Felling of selected tōtara on a farm site near Kaeo; Loading tōtara logs to be sent for milling in Rotorua (May 2018, Photos: Paul Quinlan)

The next project harvest was conducted during April 2019 on two farms near Kawakawa, with a volume target of 200 m³ standing tree volume. The target harvest volume was reduced from the 400 m³ volume originally planned due to both harvest timing and storage constraints. Tree classes 1-5 (with Class 1 premium grade trees and Class 5 deemed to have no merchantable volume, see Appendix 2 for definitions) were taken with an average of 2.3. Only around 2% of the volume recovered as sawn lumber identified as clear heartwood (based on colour variation on the boards).

The volume of the second project harvest was reduced from 400 m³ to 200 m³, primarily due to the lack of suitable timber storage facilities (the planned storage fell through at the last minute). However, permitting delays also reduced the suitable window of time within which to complete the harvest operations. This volume reduction did not put any of the subsequent milestones at risk, so the only effect was the reduction of timber volume with which to seed the market. As the recoveries were better than predicted, this reduction of final timber volume was reduced from an estimated 200 m³ to the actual 147 m³. However, the one compromise was that there were fewer harvest sites during project operations and thus a wider range of terrain, locations and scales of harvest were not able to be included, reducing the level of representation of Northland.

Overall, the harvesting and transport costs for the project operations were in the range \$160-180/m³ logs using the one-off contracting approach (tree purchase and permits/plans were additional). It might be possible to reduce such costs for the commercial operations once sufficient volumes are being harvested, by employing a crew instead of contracting them. All operational costs have been included in the operational financial model and discussed in more detail in that section.

Permitting and planning processes

Harvesting and milling of native trees, including naturally regenerated tōtara, is only legal under the provisions of the Forests Act. In this case, the relevant provisions are the Sustainable Forests Management (SFM) Permits and SFM Plans. All harvests executed by the TIP project were under, and in accordance with SFM Permits and Plans approved by Te Uru Rākau.

It remains possible to gain the legal permits required to conduct sustainable harvests of the farm-tōtara resource on private and Māori land under the Forests Act. However, it is costly and time-consuming. Issues and difficulties in applying the provisions of the Forests Act as previously identified by the Northland Tōtara Working Group remain. These include:

- Securing and applying the necessary SFM Permits and Plans under the Forest Act is both very time-consuming and expensive. This will be a concern for any future business and industry. Despite improvements and use of a tōtara-specific SFM Plan template, the time required from initiation to registration of a new permit/plan on a property tended to be well over the targeted 9 months.

- The difficulties are not so much with the intent or purpose of the Forest Act (to effect sustainable forest management), or its SFM Permit and Plan provisions. The difficulties lie rather with its interpretation and administration and what Te Uru Rākau deems necessary to maintain the ability to audit SFM Permits and Plans throughout their durations.
- In particular, the significant variability of the regenerating tōtara forest resource makes the requirements for accurate site-specific forest inventories practicably unachievable. For example, a 48 ha total Forest Area on the Cookson property was sampled at a 10% sampling rate, incurring significant cost (involving fieldwork for 48 sample plots each 0.1 ha in size), and yet, the resultant inventory still had a probable limit of error (PLE) rate of 38.2%. In order to lower the PLE to the recommended not more than 20% level, a sample rate of up to 30% of the forest area (i.e. 14.4 ha) is potentially required. Consequently, conservative models were used to set the harvest rates. These only allow low levels of harvest (often less than 1 m³/ha/yr).
- SFM Permits are cheaper and quicker to obtain than SFM Plans. However, they are not as sophisticated as SFM Plans in terms of ensuring sustainable management. SFM Permits, only apply for 10 years, and do not necessarily preclude one-off over-cuts or high-grading the forest through poor harvest tree selection, nor do they secure long-term forest protection. Therefore, SFM Plans, which have a minimum term of 50 years, are preferred. However, they are more expensive and time-consuming.
- Any timber/forest management accreditation scheme (such as from the Forest Stewardship Council (FSC)) would be an additional cost on top of those associated the TUR SFM Plan/Permitting process. Such accreditations are too costly for small forest owners, which includes all of the farm-tōtara resource.
- Small forest areas and poorer-quality forests have poorer economies of scale (i.e. relatively higher costs of permitting per m³ for low allowable harvest volumes). Yet much of the tōtara resource comprises small and scattered forest areas.
- The provisions of the Forests Act apply to specific land titles and cannot be applied to collective management of a tōtara resource across multiple properties, e.g. on a relevant catchment or landscape scale unit. No opportunities for efficiencies through collective management are provided for.

It should also be noted that the majority of the tōtara resource that exists on private land has established as a direct consequence of the disturbance from rural development. There is an argument that these forests should not be considered to be natural forests as they are rarely protected and frequently grazed.

The possibility that the Forests Act may be reviewed at some stage in the future brings the opportunity to improve the legislation but also opens the risk of an even less satisfactory situation developing. This is further compounded by probable amendments to the Resource Management Act (RMA 1991) and the proposed National Policy Statement on Indigenous Biodiversity, (which must be given effect through Regional and District Plans). Additional ecological conditions can significantly affect the costs of harvesting.

For example, a condition in the Cookson SFM Plan to consult with the Department of Conservation concerning the possible need for a kiwi survey prior to harvest, resulted in a field survey with a kiwi-dog. No kiwi was present, but the exercise added harvest costs which will equate to at least \$20/m³ of rough sawn timber volume.

Unfortunately, it is not clear exactly what changes should be made to the legislation to reduce costs and time associated with the regulatory process, while also ensuring forest protection and

sustainable management is achieved. Some environmental NGOs are opposed to any provisions for native timber harvesting and are likely to lobby for more restrictive regulations especially through regional and district plans.

Consequently, the regulatory situation for the future is uncertain and therefore represents some risk for the industry. Any business entity/industry will need to be prepared to defend its interests by making submissions and proactively engaging with the developing regulatory situation. Multiple regulatory frameworks and instruments are involved (e.g. Forests Act, RMA, Regional and District Plans etc.)

On a more positive angle, a restrictive regulatory environment hinders easy access to the resource for unprofessional players and/or widespread uncoordinated harvesting and processing which could potentially undermine a more coordinated regional industry. Harvests by other players in the native timber industry, if not conducted according to best-practice forest management standards, could bring the whole industry into disrepute.

At this stage, it is anticipated that any start-up business would need to be actively engaged in preparing SFM Permits/Plans for landowners to ensure sufficient log supply is available, and to secure some form of agreement to access that supply.

A full year is likely to elapse between meeting a landowner with a view to purchasing logs and being ready to conduct a harvest of those trees.

Key Findings: Forest

This section covers resource, site and tree selection, harvesting and log recovery.

Key points:

- The project demonstrated that sustainable forest management principles and low-impact ground-based harvesting methods can be applied to farm-tōtara stands.
 - However, the most appropriate sustainable forest management prescriptions/practices for tōtara dominant forests in Northland still need to be confirmed. This will require refinements in response to long-term monitoring and modelling of forests post-harvesting.
- The mean age of the harvested trees was 83 years (ranging from 50-150 years).
- Health and Safety of harvesting operations can be managed by a forest manager.
- Existing harvest contractors are not well-equipped for specialised low-impact and low-volume harvest contracts on and around farms. Few are willing and able to quote and, securing contracts with them is time-consuming with start dates often affected by weather and other jobs.
- Soil/moisture conditions are the primary practical restraint for harvest operations. Vehicle access and topography the second.
- The long-term timber productivity of untended, naturally regenerated tōtara stands may benefit from more intensive harvest and silvicultural interventions (including the removal of non-merchantable and poor-quality trees).
- The resource comprises many small stands of forest spread across the landscape. For most landowners, tōtara only represents a minor opportunity for some income and land-use diversification. It is yet to be proven that there will be widespread interest from landowners willing to participate, sell or actively manage their tōtara trees.
- The farm-tōtara resource is a wild population with considerable variation in stem form and no forest management to improve productivity. Individual tree selection provides the opportunity to improve future stand productivity by removing poorer formed trees while still recovering high quality timber.

Other findings:

- Site selection has been relatively straightforward, although arguably we have not really tested that part of the operation given all sites used in project harvests were previously known to Paul Quinlan. Paul has been integral to the project through his database, contacts and relationships developed through the Northland Tōtara Working Group.
- There has been significant variability in the tree quality and heartwood content at each harvest site, not a surprising result given we are dealing with a wild population that has largely been untended.
- Tree selections have erred on the conservative side with many trees selected that have resulted in reasonably large quantities of “waste”.
- Tree form has largely been a consequence of selecting trees either close to or on forest margins.
- Removal of individual trees has had little impact on the residual forest structure and in most instances will not lead to increased tree growth or new regeneration (due to insufficient numbers of trees being removed and therefore insufficient light gaps being created).
- However, project harvesting operations mostly took trees from edges of stands, so this aspect may need further attention in the future.
- Farming impacts – unrestricted grazing – is seen as more detrimental to forest health than the harvesting.
- The Forests Act specifies the harvesting and extraction of podocarps (e.g. tōtara) using selecting single-stem or small groups (e.g. 3-5 trees) selection systems. It is not clear whether this is the most appropriate forest management system to ensure the sustainability of tōtara-dominant stands (i.e. larger clearings (coupes) may be necessary to ensure sufficient regeneration of tōtara which is a light-demanding species). Sustainable forest management prescriptions/options for tōtara-dominant forest require more research and refinement.
- MPI SFM plans are very conservative with regard to setting the approved maximum sustainable harvest volumes. This does not recognise the potential productivity possible through intensive silvicultural management – including effects of appropriate harvest interventions to improve the long-term quality of the forest in respect to the stocking of trees with merchantable volume.
- Some of the estimated and permitted ‘merchantable’ volume is not able to be recovered (usually between 5-10%). There are several factors that account for the discrepancy:
 1. No tōtara specific taper-volume equation exists (we use the J.C. Ellis equation for rimu), and;
 2. Minimum (e.g. 3.1m) and maximum log-length specifications for truck transport and for milling, mean that the total theoretically merchantable log volume from felled trees cannot always be recovered. Short log lengths are frequently left in the forest.
- No long-term damage has occurred on any of the harvest sites to the farming infrastructure.
- Harvesting crews have been difficult to find who have the appropriate experience and scale of equipment. We have largely “made do”, rather than optimised this component right throughout from tree felling to log loading.
- Weather has been a major limiting factor in access and harvesting.
- Helicopter harvesting was costed as an option at two sites but is significantly more expensive than ground-based extraction options. At this stage, it appears cost prohibitive.
- The costs to date are not reflective for a new business start-up. However, the costs we have accumulated are probably a worst-case scenario given it was not possible to optimise the harvesting and log recovery machinery.
- Options for appropriate machinery have been investigated that would improve access through farm infrastructure, reducing damage to pasture and farm tracks.
- Transport of logs from the harvest sites to mills in Rotorua and Northland have been similar as to pine log transport, except for the issue of loose and hanging bark on logs.
- Log assessments prior to milling have yielded valuable information on volume recovery versus standing volumes, log qualities and heartwood content.

- Heartwood content is highly variable and not predictable from diameter. A heartwood model has been developed that indicates heartwood content is not predictable at the individual tree level, particularly in the age and diameter distribution the TIP project is working with.
- External log defects (i.e. large branches) do not appear to result in as much lumber degrade as expected.
- Recovery of “waste” for chemical analysis should be a priority to make better use of each tree felled. There is the opportunity to explore other aspects of the trees extracted, such as the seeds, fruit, bark and other non-timber materials that could present further value
- Harvesting operations have not indicated any major issues that could be considered “show stoppers”.
- The risk of supply continuity of the resource has not been completely mitigated and some risk still remains. There appears to be sufficient resource for a smaller scale business that would be viable. However, the assumptions at this stage are that scale of resource will require some way to co-ordinate the collective resource in order to obtain and secure cumulative scale and continuity of supply. This is discussed and analysed in more detail in the Business and Financial model section.

Sawing and Drying

The required permits for milling were obtained prior to processing the tōtara logs. The logs from the Stage 1 harvest (100 m³) were transported to a training mill run by Toi Ohomai in Rotorua and milled there according to specifications into 25 mm and 50 mm boards. Drying studies were conducted in Rotorua at Scion, starting late June 2018, to develop kiln schedules for the two board sizes, with results compared to the traditional air-drying method. The log to lumber conversion for the first harvest was 52% which was encouraging, given the restricted brief given to maximise sawn lumber in only two sizes, 25 mm and 50 mm boards. For comparison, the PwC financial model drafted prior to any harvest or processing had assumed a lower value of 40% log to lumber conversion.



Illustration 2 (L to R): Assessing heartwood content at Toi Ohomai training mill site; Logs going through sawmill; Tōtara boards after grading prior to drying (June 2018, Photos: Greg Steward and John Lee)

Grade recoveries for Stage 1 timber were good with 60% volume in the top two grades (clear and dressing) with heartwood and sapwood combined. These results compare to the small pre-pilot study where over 70% were in these top two grades. This illustrates that grade recoveries of timber and other metrics such as heartwood content of each site will probably be dependent on the local growing conditions, terrain, tree population and stand characteristics (e.g. stocking rates and tree quality). The data are shown in Table 1, with more results and the pre-pilot data shown in Appendix 3.

Table 1: Dressed volume recovery (m³) by grade and dimension of the first TIP harvest

Grade	Dimension (mm)						Total	%
	75×25	100×25	150×25	150×50	200×25	200×50		
heart clear	0.015	0.074	0.078	0.214	0.060	0.117	0.559	1.5
heart dressing	0.008	0.064	0.580	3.743	0.354	3.839	8.588	23.4
heart mixed	0.011	0.108	0.175	0.2528	0.208	0.154	0.908	2.5
heart box	0.008	0.029	0.170	2.125	0.129	1.696	4.155	11.3
sap clear	0.396	0.577	0.612	0.189	0.392	0.083	2.249	6.1
sap dressing	0.375	0.862	1.700	3.744	1.642	2.686	11.004	29.9
sap mixed	0.399	1.079	1.290	0.251	0.694	0.103	3.817	10.4
sap box	0.145	0.325	0.556	1.454	0.645	2.348	5.473	14.9
Total	1.357	3.1169	5.158	11.972	4.122	11.026	36.752	100

Kiln-drying schedules were developed for green timber boards (using Stage 1 lumber) on small research kilns (maximum board length 600 mm), then the most promising schedules were scaled up (maximum board length 2.4 m) for 25 mm and 50 mm boards. This was the first time that successful kiln-drying schedules have been known to be developed for green 50 mm boards. The key success factors were to maintain very tight process control and high humidity in the initial stages of drying. The use of a water bath was important to achieving reasonable drying times and the ability to kiln-dry 50 mm material. Qualitative comparison of traditional air-drying with kiln-drying showed that degrade was about the same.

Later topping-off schedules were developed and used to successfully kiln-dry partially air-dried 50 mm boards in a smaller training kiln (up to 30 m³ capacity). A total of 20 m³ of 50 mm boards was kiln-dried to 12% moisture content (MC), after the boards had been air-dried for around one year in an enclosed shed (estimated to be at 20-30% MC).

The logs from the Stage 2 harvest (200 m³) were taken to a commercial sawmill, Northpine in Waipu, and sawn into 25 mm and 50 mm boards, as well as a few slabs, squares and small cross-sections. One charge of 25 mm boards (47 m³ dried timber) was dried in a kiln to a specified schedule, developed in the earlier drying studies, and achieved a final moisture content of 11.3%. The remainder of the green timber was taken to air-drying facilities in Rotorua. The log to lumber conversion for this second harvest was 56%, with the sawmill giving the view that this figure could be optimised even further with a more targeted cutting regime (mix between 25 mm and 50 mm boards).

A portable sawmill trial was explored as part of this second project harvest but was not possible to arrange. One aspect that would need to be addressed would be compliance to current H&S regulations (including the requirement for extensive documentation). It is likely that future use of a portable mill could be potentially suitable for a small volume of bulkier logs as the costs were significantly higher per m³ than the commercial sawmill. Portable sawmills may also enable more stakeholders to participate in the industry as a complement to commercial centralised milling activity.

Grade recoveries for Stage 2 timber are shown in Table 2 and were 65% for the top two grades (dress and No.1 clears), a value between the first TIP and pre-pilot harvests. Timber was not classified as heartwood and sapwood by grade for this harvest, but it was observed that heartwood content of logs was much lower in these two farms sites.

Table 2. Dressed volume recovery (m³) from the second project harvest (Stage 2)

Grade	Dimension (mm)									Total	%
	50x25	75x25	100 x25	100 x50	150x25	150x50	150x100	200x25	200x50		
Dress	0.45	0.32	4.05	0.90	21.27	11.81	-	9.94	5.07	53.81	51.7
No.1 clears	-	0.47	2.42	-	4.958	2.79	0.9	2.18	-	13.72	13.2
Mixed	-	0.52	1.89	0.72 6	7.53	1.58	-	6.21	2.31	20.77	20.0
Slab	-	-	-	-	-	-	-	-	0.82	0.82	0.8
Box	-	-	0.38	-	3.711	5.17	2.7	1.53	1.44	14.92	14.3
Total	0.45	1.31	8.73	1.63	37.47	21.35	3.60	19.86	9.64	104.03	100

Note the extra dimensions produced. Other data are given in Appendix 3.

The high quality of the grades obtained in this second harvest (Table 2) was somewhat surprising, given that a higher portion of poorer form trees were taken. These results are very encouraging as these two farm sites were in a different part of the region (near Kawakawa) to the first two farm sites (near Kaeo). This gives confidence of high grade recoveries across 4 sites (including the pre-pilot study), as well as increasing log to lumber conversion rates.

Many of the external defects seen on logs in the mill yard have been shown not to penetrate deep into the log. This has been one of the reasons why higher conversion rates have been achieved. Milling of the first project harvest was to maximise sawn lumber recovery and was without guiding industry standard dimensions. Hence the second milling operation of the second project harvest recovered a number of different lumber dimensions including slab grades and larger dimension “sleeper” grades.

Sawn lumber remained comparatively stable in unrestrained packets of timber. Where excess movement has occurred, this is often related to the presence of large distorting knots, and where timber was stacked and stored in sheds where excessive summer heat was experienced.

At Scion, scanning of discs recovered at the mill yard (with the DiskBot machine) to characterise wood quality, characteristics and chemistry associated with heartwood content has not yet been achieved (due to lack of machine availability). However, other preliminary investigations into heartwood content have been initiated but are still in progress (another couple of years likely).

Contracted costs for sawmilling at the commercial scale mill came to around \$125/m³ log volume. This cost was based on the time used to mill and clean up afterwards (bark). So, this cost could be potentially reduced by more rapid throughput and having a more effective way to deal with the long stringy bark.

The contracted costs for kiln-drying the one charge of 25 mm boards was based on the per day operational costs for radiata pine. This came to around \$171/m³ dried timber volume. However, the tōtara kiln schedule uses lower temperatures and airflow than required for radiata pine with a longer time. In an appropriately designed lower temperature specified chamber, running and fixed costs would be reduced. Another potential option for reducing costs of drying larger dimension timber may be solar kilns that could possibly be used in combination with a portable mill on a farm site.

Key Findings: Sawing and Drying

- It is apparent that the industry has lost most of the previous skills and experience in handling and processing native logs.
- Commercial milling operators were initially concerned about log qualities and had a lack of experience in cutting native logs to maximise recoveries.

- Milling was largely straight forward with better than expected volume and grade recoveries. All lumber has been graded.
- Bark would ideally be removed before sawmilling, as it is a transporting hazard, hinders higher throughput and clogs the sawmill machinery.
- There is an opportunity to look more closely at the residues from milling (chips and bark). We need to be looking at a range of viable options to add value, possibly including bio-extracts, energy and/or securing a long-term landscaping option.
- Onsite portable milling may result in new additional markets for large slab piece sizes, although drying for extended times would be an issue
- External log defects (i.e. large branches) do not appear to result in as much lumber degrade as expected
- Costs associated with milling may have been higher than would have occurred in a commercial operation given the scientific discovery nature of the project.
- Drying schedules have been developed that will significantly reduce the time lumber is held. This means that tree stocks can be left “on the stump” longer, thus increasing future volume.
- Kiln-drying has not resulted in any significant lumber degrade.
- Kiln-drying thicker boards (50 mm) is yet to be demonstrated at commercial scale. Lab scale trials were successful but tight process control is required over extended periods (15 days). There would also need to be dedicated kilns for the kiln-drying of both 25 mm and 50 mm boards due to the length of time required to dry these compared to radiata pine.
- Sawing and drying operations have not indicated any major issues that could be considered “show stoppers”.

Market and Brand story development

The majority of activity in this work stream was around market testing and validation of the farm-tōtara timber. This included a preliminary market test with a small volume of timber given to JSC Timbers to show selected clients and test the range of applications that this timber would be suitable for. We received initial and on-going feedback on suitability for a range of applications as well as indications of price point.

Subsequently, product evaluation trials were set up to look at possible interactions with coatings and fasteners, and timber merchants were engaged to sell the project timber on TIP’s behalf to further test and seed the market.

There was little brand development conducted as this was deemed to be too early. However, the kaupapa, the environmental benefits, the gathered stories and the provenance of the harvested trees will be a key point of difference for the future industry. Discussions were also held about possible points of difference that may in the future be inputs to a branding exercise. This will be important to address in the next stage of commercialisation with project timber needing to be differentiated in the market. In particular, developing the market requirements of the value-added product options such as carving will need to be undertaken in a very intentional manner and in line with the developing tikanga, as outlined in the roadmap.

Documenting the best-practice sustainable harvesting approach that was applied, helps to build the background credibility and sound reputation that a future industry will need as a foundation.

Market testing and feedback

Dried tōtara timber (8 m³ of 25 mm boards, mixed grades) was sent to JSC Timbers in February 2019 for initial market seeding and feedback. We received feedback that indicated price points per grade for a range of clients and applications. So far, the feedback and price points were in excess of what had been used in the original PwC financial model. For example, this early

financial model assigned price points in the market for each grade, from the lowest box grade at \$400/m³ to the highest clearwood at \$3000/m³ (with a weighted average of \$1866/m³). However, feedback from these initial offerings to potential clients, set the lowest grades much higher, at over \$1500/m³. There has also been an increased range of applications not previously considered (e.g. coffins, craft objects). This feedback increased confidence that the market risks can be overcome and that costs of carefully extracting farm-tōtara are viable at these price points.

Two timber merchants, JSC Timbers and BBS, supporters from the start of the project, were engaged with to sell the project timber from July 2019, as more timber was becoming available as kiln-dried or with air-drying almost completed. In October 2019, JSC Timbers signed the timber sales agreement for the TIP project timber, and later BBS decided against signing due to changed circumstances (e.g. lack of storage). This agreement set the price point to TIP from the timber merchant at a discounted value which was designed to cover most of the direct costs of harvest and processing. Part of the agreement was that the merchant would be proactive in developing the market for farm-tōtara and send feedback from their and their clients' experiences of this timber in use for a wide range of interior applications. We excluded exterior applications at this point as there are no long-term field tests completed on the heartwood of farm-tōtara yet. Therefore, the durability for outdoor applications cannot yet be confirmed.

By December 2019, 14.3 m³ timber volume had been sold via the timber merchant over two orders, with more long-term orders pending. However, this activity was interrupted by the Covid-19 pandemic, subsequent lockdown and other restrictions.

There will be market competition with other timbers for the targeted products, as well as from existing tōtara from other players in the market. In particular, there is no shortage of high quality veneers (e.g. 0.6 mm veneers for furniture) from traditional old-growth trees. We supplied thin veneers to a furniture maker from the Northland farm-tōtara resource; however, they thought the quality was not good enough to use. Consequently, the farm-tōtara veneers were used on the underside of the table tops. This could have been a colour matching issue and something that might need to be considered in the future.

JSC's approach is to promote and sell direct to architects, specifiers and builders, as they realise at this stage the farm-tōtara needs specialised market support in these initial stages of development. Presently, JSC market farm-tōtara as a 'cut of log' grade, meaning that it is not graded into clears, dressing and feature, but includes 'rustic' features such as knots and defects. Architects have been coming with requests for tōtara, commonly for old growth in large sizes, but after a conversation are open to farm-tōtara options.

JSC have canvassed a wide range of potential clients and found there was a difference in geographic location in people's acceptance of farm-tōtara. North Island customers were receptive of farm-tōtara, whereas South Island customers were more concerned about cutting down native trees, so needed more information to make an informed decision.

There has been good level of interest from potential clients in using farm-tōtara. It has been specified on many jobs pending with JSC, but, in the current situation, houses are more likely to proceed earlier, as the larger jobs will take more time, typically 6-18 months (all this activity is Covid-19 dependent).

The feedback and direct market experience from selling the TIP project timber gave confidence to increase the weighted average used in the operational financial model up to a higher value of \$2200/m³, although this metric has a significant impact on viability outcomes so low and high values were used as part of a sensitivity analysis (for further details, see operational financial viability section, pg 34).

Timber performance

Product evaluation trials were set up with dry timber in June and July 2019 to observe any interactions between specific products and coatings under in-service conditions. Therefore, weatherboards and decking were set up outside (see Illustration 5), and wall panelling and flooring samples were placed inside and changes in appearance and coating performance were noted. Durability performance was not assessed as there was not sufficient heartwood for the replication required for such tests. It was found that discoloration developed near screws on outdoor decking boards which might need more investigation.

JSC Timbers have conducted some trials with a fire retardant (FR) product on farm-tōtara timber. They found the FR applied well and did not change the colour or appearance of the timber. It was suitable for rough sawn surfaces and edges as well.

JSC Timbers also found that the wider boards (200 x 25 mm) were not preferred for wall panelling as they were considered too wide. In general, the farm-tōtara is not being used for structural applications. However, the 200 x 50 mm boards have been specified as exposed rafters inside houses (SG6 grade), and there is wider interest in using farm-tōtara as exposed interior rafters.

Other end-user feedback:

The project timber was also donated to three cultural uses and for one product demonstration piece, and feedback gathered from these users:

1. Flooring for an historic church (Wooden Earth Creations) - Illustration 3
2. Decorative waka carving (Lyonel Grant) – Illustration 4
3. Replicate kō for museum and machining trial (Woodmasters)
4. Window joinery (Optimal Windows)

Timber was gifted from the TIP initiative for the restoration of the floor of the Samuel Marsden Memorial Church at Matauri Bay, Northland. The floor installer, Joachim Kupiec from Wooden Earth Creations, reported that the timber which was oiled “came up well and was looking great”. The Pastorate was also very pleased with the result as the old native flooring had not been able to be replaced until this timber was donated.



Illustration 3: Samuel Marsden Memorial Church at Matauri Bay. Floor replacement from chipboard (before) to farm-tōtara (after) from a farm site nearby

The waka carver, Lyonel Grant, reported that the air-dried timber supplied to him was easy to work (adzing and carving) and laminated well for the large carving. Lyonel thought that laminating the farm-tōtara, which was of lighter colour than old-growth tōtara timber, gave the opportunity to emphasise aspects of the carving with stain. For such decorative carving, matched colour and straight grain are important qualities. This was achieved with this supply of farm-tōtara as it was possible to sort through the available timber to select suitable boards. The laminated boards glued and coated well. Overall Lyonel’s conclusion was that he would “consider using this material as an alternative to the dwindling old-growth supplies, especially for corporate art applications”.



Illustration 4: Demonstration stand (two sides) with interior products of wall panelling and flooring (L), and exterior products of weatherboards and decking (M). Lyonel Grant forming laminated carving structure for the waka carving, the carving in progress and the completed carving being installed (R & B)

The craft-makers, Woodmasters, who made the replicate kō for the museum, were interested in a potential supply of farm-tōtara in their business which made a large number (30-50,000 pa) of small craft items. They also indicated a very good price point they would pay for the lower grade timber (>\$2000/m³). Museum staff said that this kō would last much longer than the previous replicates made out of radiata pine timber. Woodmasters also ran a general machining trial to see how the farm-tōtara performed for small decorative carvings. They found that “the timber generally machined very well and there was no more chipping around knots than we would expect from any other species.” They used a CNC router with which it performed very well. They found that it even sanded better than old-growth tōtara heartwood which tended to gum up the sander.

Sam Burges of Optimal Windows made a laminated window from the farm-tōtara for demonstration purposes, and also found that the timber glued and machined well. The ultimate test will be how this window performs in service but so far, the dimensional stability looks good. The durability (decay resistance) would be important for this potential application as well as price point with the main competitor seen as Western red cedar. The sustainability credentials of the farm-tōtara were seen as the key positive attribute.

Product evaluation trials were set up to observe the performance of the farm-tōtara with various coatings in interior and exterior situations. These were not durability trials where the decay resistance would be measured over an extended time. In general, the timber performed well, taking all the coatings types and gluing well. However, one issue was noted: on exterior decking

stainless steel screws had a reaction on an oiled sample in the form of a grey discoloration around screw head (see Illustration 5, detail in circle).

Overall, the positive features of the farm-tōtara were deemed to be sustainability, consistent colour and availability, with the key competitors being imported timbers. Features that could be further developed might be matched colour options and grading by wood features.



Illustration 5 (L to R): Decking trial on installation and after 12 months exposure (circle with staining near screws)

In summary, the performance feedback received from these users of the timber indicated that the farm-tōtara timber is suitable for a range of interior and potentially exterior applications (once a suitable level of durability is confirmed) and that it is machining, coating and gluing well. Key positive features were sustainability and potential availability (security of supply).

Brand story and provenance

Having a unique story that sits behind the farm-tōtara has been identified from the start as being an important point of difference in how products from this special resource might be positioned. Consideration of stories and provenance has been explored in more depth as part of the Steering Group's expansion of our strategic intent.

However, it was deemed to be premature to conduct a brand exercise in the first half of the project for a product and business entity that did not yet exist and for which product targets had not been agreed. It had not been intended to undertake a full brand exercise as part of this project but even starting such a process would require decisions and assumptions to be made in terms of general positioning and product targets. It was decided to leave a branding exercise till later when there was more certainty on what kind of business models and structures would be used with specific business partners and owners identified, as well as having more market feedback on the farm-tōtara with specific product applications.

However, JSC Timbers have provided feedback on branding from their experience of selling the project timber as "farm-tōtara", into the New Zealand market. Clearly more needs to be done in terms of promotion and branding to differentiate the farm-tōtara as being new in the interiors market. There is always risk in introducing new materials and products into a market and the project scope did not include funds for a product launch, promotion or a full branding exercise, which will be needed in this next stage to continue momentum. JSC has also indicated that a more formal brand name is required, in their view, to properly promote farm-tōtara.

So, there has been tension between being part of a de-risking feasibility pilot project and selling project timber to seed the market without a brand in place.

Expansion of our Strategic Intent:

As the Steering Group has met throughout the TIP project, we have focused on one aspect of our strategic intent in most meetings and expanded out what we think this aspect means to each of us. Pita Tipene has led these sessions.

Brand and provenance stories.

Provenance might be the easier aspect. Provenance is more than just where the tree was grown but local conditions and how it came to be, who harvested it. Provenance is more than place (narrative, the meaning of tōtara, people and how they connect).

- Where does the Māori story come into the provenance? More time is needed to consider this aspect.
- The stories need integrity and authenticity.
- When will the brand story be done, a role for the future entity?

For Brand - what does this look like? What is our goal around Brand for this project?

- First need to identify.
- Don't want to brand the project but this project has many dimensions that can be used for brand development (this is nearer to market and can be degraded by others who leverage our brand).
- Brand is a bit intangible (e.g. Harley Davidson vs Honda, or tōtara vs radiata pine).
- Not actual branding but what sits behind what we want here.

To foster opportunities to that builds capacity, capability and participation.

- What does this look like? Compared to radiata, the numbers involved in this will be low.
- Will this be a new entity or existing? Both processing and training. Trying not to presume too much about the model or entities that might emerge. Enabling some of the existing mills and operations to participate might be a way forward. This approach would see them gain new skills. Don't want to limit how this can happen.
- Knowing the current capability, capacity and desire to be involved are part of the pathways going forward, some of this will emerge from the Stage 2 harvest.
- Communications plan may also have a big opportunity to play as people may not know the true opportunity that this could lead to. This might start to see a realisation of the project.
- Participation – we need the right communications, so people know about it. But then need to consider what does a sustainable operation look like?
- This goal interacts with several other goals – Build scale, generate & retain wealth. Ultimately, we would like to see Northland become the Tōtara capital of the world!!
- We need to ensure we keep this level of openness for increased participation.
- We need to start activity then it will grow.
- We could turn what might be seen as a liability into an asset.
- Already people are asking what is happening in TIP and how can they be a part of it.
 - One way they can keep updated is to join up to NTWG and then they will get updates on TIP.
- Some sawmills might have facilities but are not interested.
- This TIP model might be able to be used for other regions and other wood species.

Retaining wealth in the local community

Brainstorming on what this means as a goal:

- Employment – building capability and skills
- Enabling local community - wealth of knowledge

- Environmental - health - a holistic approach and not seen as being separate from commercial etc
- Cultural values (of having tōtara in the region) - part of regional identity/symbolism
- Understanding (education) about forest ecosystems – water protection etc
- A kaupapa that allows value to fall in the “right” places e.g. the wealth of the land
- Niche markets – Boutique industries
- Control of value chain – strategic influence
- Local community means:
 - Taitokerau
 - Local communities (get the employment locally)
 - What we don't want value being maximised outside the local valleys (e.g. long-term leases) & logs going offshore
 - How do we enable the local community to truly participate in this initiative and benefit – locally based companies
 - Get involved in local school curriculum (e.g. based some units in the tōtara forests on local farm)
 - Forest management e.g. forest control, like tracking
 - Breaking away from a Whangarei-centric approach so that other local communities are appropriately valued and included

Kaupapa: “Kei te tohunga te whakaaro – The carver brings the wood to life”

Brainstorming on what this means:

- Kaupapa - this is what we have called this statement – this is what we are here for
- There was a second half to this statement – the wood brings the carver to life, making a circle.
 - Interdependency between man and the environment.
- Biodiversity is food for all of us
- Recreating the connections between people and the land (in many ways)
- The power of the mind to create value (individually and collectively)
- Viewing something and bringing it to life
- Provide a catalyst to create momentum and triggering action/s
- Bringing the mana back to the tree and the people who are connected to the tree
- A metaphor for bringing greater vigour to our communities
- Whakapapa and stories of the tree
 - An example of this is the church floor dedication, where the stories (including those “lost” or forgotten) of that community were able to be told
- Climate change and the potential contribution of tōtara
- Building capacity/capability (e.g. kaiwhakairo), growing skills
- Mauri - the life force

Key Findings: Market and Brand development

- Market feedback from selling and using project timber indicated increased price points, giving confidence for potential higher returns to the selling entity (weighted averages for all grades).
- The target market selected was for interior applications including wall panelling, ceilings, and furniture. Structural uses have been requested by a few clients but is not being actively promoted. Exterior applications have been excluded due to lack of field data on durability of farm-tōtara heartwood.
- Technical feedback on timber performance indicated that it machined well with few processing issues arising.
- However, there was some timber discoloration around screws in an outdoor product trial (which may need to be investigated further).

- There was interest expressed in sustainable supplies of farm-tōtara from a range of potential clients such as architects and builders.
- No brand exercise was conducted as it was deemed to be too early and more suitable for the eventual commercial entity to conduct. However, this is now becoming more urgent with farm-tōtara being sold in the market and needing to be differentiated.
- Discussions were held on important aspects of provenance and sustainability being the key points of difference that would need to be part of any future brand.

Enabling Environments

The Enabling Environments work stream looked to cover aspects of activity that would create or build more conducive conditions for the industrial use of tōtara in Northland. This ideally includes legal and social aspects. However, work under this work stream has focussed on social rather than legal licence to operate activities. The legal aspects have been somewhat covered under the Forest work stream with the TIP experiences of operating within the current Forest Act, obtaining permits and plans under which to conduct the project harvests. It was not intended to develop recommendations for changes within the legal framework from this Pilot. Project partner, Tane's Tree Trust, have been continuing to engage with Te Uru Rākau on this matter.

The approach has been to engage with a range of stakeholders with the view to increase support for the development of industrial use of tōtara. Therefore, activity started with mapping the landscape of stakeholders and the plan included conducting interviews, meetings and workshops with selected stakeholders from each category.

The development of a communications plan for the wider project occurred in parallel with this more focused social licence to operate work, and ultimately interacted and then integrated with the TIP contracted Communications manager, Peter Heath (Due North) who handled website, media and production of resource materials. Peter then worked with the Operational Team to extend the stakeholder management into the wider Northland community groups.

We note that social licence to operate is not something that can be “achieved” for such a project and therefore will need to be on-going and even more important for a commercial entity.

Social Licence to Operate (SLO)

There is potential harm for any future farm-tōtara business due to negative perceptions towards harvesting native trees held within the Northland and wider community. A key driver is the public valuing of indigenous forests as conservation areas, which arose from the concerted public pressure and activism in the 1970's and 80's over exploitative logging in indigenous forests, resulting in the Crown owned indigenous estate being protected and the establishment of the Department of Conservation. This reflected a societal shift in the value of indigenous forests from timber utilisation to environmental protection and ecological value. A second driver is the public understanding of 'logging' as being large-scale clear-felling as practised in the exotic estate with the complete removal of stands and understorey.

Social licence to operate (SLO) is a mechanism for parties (not just companies) to develop an environment of trust between stakeholders and treaty partners. *Providing information alone will not build the required trust, especially when provided information is interpreted as public relations.* Building long-term relationships founded on trust is the key, which is based on deep respect for people's values and personal preferences, as well as understanding the importance of place (i.e. where the tōtara is grown) to different stakeholders and Treaty partners.

SLO enables mutual trust to be built on a foundation of actions and behaviours that develop legitimacy and credibility. Legitimacy addresses aspects such as wellbeing, respect, including respect for values, and procedural fairness. Credibility addresses promises and promise keeping, dialogue, and sharing of information.

Trust is the confidence that 'company' behaviours will match community expectations and is based on principle and competence. Trust is eroded by perceived and actual bias towards privileged stakeholders, or by inequality in benefit sharing, a lack of fairness, e.g. benefits to land owners, negative impacts to community and broken or hollow promises.

SLO is an active ongoing process that is always being undertaken and hence, forms part of a company's strategies and processes. This project was not implementing a SLO programme as it is for the new entity to build the relationships and trust. This project implemented a process to identify areas of concern arising from social risk and acceptability.

Stakeholder engagements

Selected stakeholder engagements were conducted in the latter part of the project to follow up with stakeholders, to update them and get their views of the next phase of the initiative. Targeted stakeholder engagement was split into community-based groups such as councils and community boards and Māori engagement.

Selected stakeholders were offered a brief overview and update of progress of the TIP project, using pictures to illustrate where possible, then comments, thoughts and questions from those attending were invited, and this feedback gathered. Attendees were sent links to the TIP website and video, along with a one-page project summary put together by a project partner.

Community-based stakeholder briefings were facilitated by Peter Heath of Due North. These briefings covered community groups such as district mayors and councils, community boards government ministers, environmental NGOs, land-owner bodies, community groups, forestry sector groups, state service departments and finally the regional media.

In all, 11 formal community briefing meetings were held remotely, with a total of 20 organisations and over 45 people attending. In all, over 28 organisations were offered the briefings during this time. This does not include follow-up meetings and responding to media enquiries, nor the Māori engagement process reported on below.

The feedback from the community engagements was largely positive with many offers of practical support. Key topics of interest were wide-ranging and included: details of the tōtara resource, the Forest Act and permitting process, value for the landowners, scale of project and future proposed operations, and the proposed business model and financials.

The Māori-based engagements were conducted remotely during May and June 2020 during lockdown. These briefings were offered to a wide selection of Māori around the region, regardless if they had already been engaged during the community briefings due to their professional roles. In all, 10 briefings were conducted based loosely on rohe, with a total of 106 people attending. The feedback showed that there was strong interest from Māori in the current kaupapa and future involvement, with the need for the future operations to be led by Māori. There was interest in details of how kaupapa and tikanga were practiced during TIP, with more knowledge offered and available of how these could be further developed and applied. In particular, there were discussions on how the scope could be expanded to include consideration of the seeds, fruit, leaves and other non-timber aspect of the trees. Another topic of interest was how to develop the whenua if they did not currently have tōtara present. Other topics discussed were similar to the community briefings such as how the financials stacked up and the business structures needed.

All these stakeholder engagements and the positive feedback received along with offers of support increased the legitimacy and credibility of the future operations.

Outcomes:

Communication outwards was established, and a range of vehicles were developed for inwards communications to ensure that good quality information was available and accessible, and that people's feedback and views were canvased.

- A website was developed that describes the project: its values, kaupapa and activities. This has been a significant tool for communicating the project, especially the opportunity and to allay the key concerns (e.g. introducing selective tree removals).
- Wider engagement was undertaken with interviews across a range of targeted stakeholders, in addition to the stakeholder briefings in the latter part of the Pilot. Such stakeholder engagement will be on-going as the TIP initiative moves into a commercial implementation phase.
- A survey was developed for the website as a consultation tool but only relatively few responses gathered to date.

Key Findings: Licence to Operate

- There was little evidence of the anticipated adverse reaction to the idea of harvesting a native tree for commercial purposes.
- There are indications that parts of the conservation lobby are still opposed to harvesting in native forests (some news stories, and some anecdotal feedback).
- What can be inferred from new and developing policy documents (such as the Draft National Policy Statement for Indigenous Biodiversity) is that sustainable harvests of native forest on private or Māori land is not being provided for as an anticipated land use.
- Interviews with those in the potential value chain have identified no issues.
- There have been informal meetings by members of Tane's Tree Trust with government ministers and with some environmental NGO's from which there has been no negative response.
- News stories from the use of the timber for the Matauri Bay Samuel Marsden Memorial church in January 2019 generated no negative feedback

Evaluation of operational financial viability

This section includes the partial and full revision of the operational financial model (first developed by PricewaterhouseCooper, PwC, in 2015), and the revision of regional benefits estimated in the business case as outlined in the project proposal.

Financial models

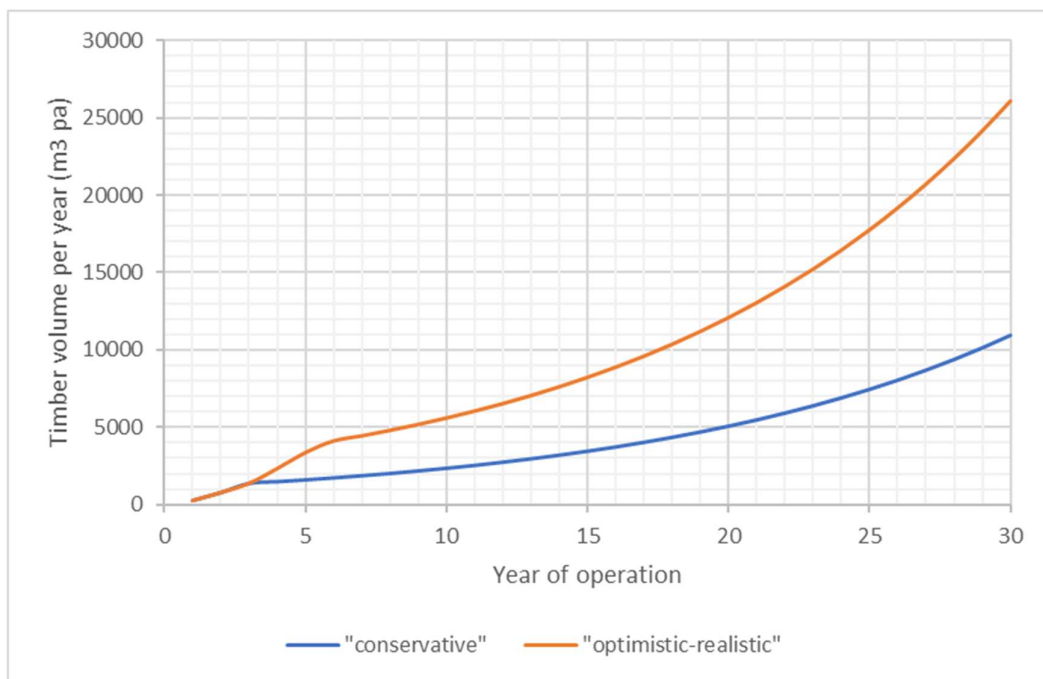
In 2015, PwC was commissioned by the early TIP group to provide an operational financial model over a ten-year period, based on a number of inputs. They provided several key outputs that indicated financial viability of the proposed business opportunity. At that stage, no trials had been conducted on selective extraction of farm-tōtara, processing or market testing, hence, expert estimates were used for many of the inputs for the financial model.

During the project, a substantial amount of new evidence and information was gathered that provided a better understanding of the overall investment proposition and enabled us to refine most of the model assumptions and inputs. After Stage 1 operations and data collection, the model was partially revised and limited number of inputs were changed. This partial revision was mainly focused on updating the model inputs related to tōtara resource availability (i.e. annual log volume), yield and grade recovery, harvesting, milling and drying costs, and timber price.

At that time (mid 2019), one of the main findings of the project was that estimated land area of readily available resource of tōtara-dominant stands (26,500 ha) was much lower than that previously used (200,000 ha of stands containing tōtara). This was to take a more conservative approach and represents a worst-case scenario, but this has important implications for the viability of the business case. Nevertheless, updated and evaluated model scenarios suggested that this business case could be viable even with a lower volume of tōtara logs if 8% discount rate is used (a rate commonly used in forestry-related evaluations), rather than 15% rate originally used. For example, even the very conservative scenarios in terms of volume and timber price yielded an internal rate of return between 15% and 18%. One of the outcomes of this revision was also the conclusion that if a truly robust financial assessment was to be produced than all assumptions and inputs in the PwC model need to be revised. Moreover, the original model (10-year period) needed to be adapted so it would cover a thirty-year period to allow for the assessment of the long-term prospects of the business.

After the Stage 2 operations were completed, a full revision of the PwC financial model was undertaken where all the assumptions and inputs were considered, and time-span of the model was prolonged to a thirty-year period. More than 50 inputs and time-series were evaluated and modified according to the gathered evidence and newly acquired information. One of the main inputs is a time-series of the tōtara resource volume, i.e. log volume. We prepared two projections based on the information on resource availability in Northland (area of tōtara dominated forests), success of land-owner engagement, mean annual volume increment rates that are used for determining allowable harvest intensity, and initial logistical constraints (descriptions below). Some metrics are common to both scenarios such as land area of tōtara-dominant stands is (26,500 ha), 20% of this area is available for TIP harvests and starting log volume (year 1=500 m³ and year 2=1500 m³). These two scenarios for projected timber volumes per year are shown in Figure 3 (note this is using timber, not log, volumes).

Figure 3. Projected timber volumes per year over a thirty-year operation.



Conservative projection

- Farm-tōtara resource: volume calculations based on currently used allowable harvest rate (~50% of 1 m³/ha/yr growth rate, MAI) throughout the 30-year period.

- Log volume: by year 3, the log volume would increase to 2650 m³; after year 3, the log volume would increase by 8% consecutively each year.

Optimistic projection

- Farm-tōtara resource: for first 3 years, volume calculations based on currently used allowable harvest rate (~50% of 1 m³/ha/yr growth rate, MAI). From year 4, a higher MAI rate is used, i.e. 3 m³/ha/yr, for defining the allowable harvest intensity. This requires an agreement by TUR/MPI to use these literature-based higher growth rates for unmanaged younger regenerating farm-tōtara.
- Log volume: by year 3, the log volume would reach 2650 m³ (as for the conservative scenario). In year 4, the log volume would increase to 4500 m³, in year 5 to 6500 m³, and by year 6 it would reach 7950 m³ (using the above higher MAI rates); after that the log volume would increase by 8% consecutively each year for the 30-year period.

In both scenarios, we used a 55% yield (i.e. log to lumber) for the conversion of log volume to roughly-sawn and dried timber volume and a 6% volume loss due to drying.

It is important to note that these two volume projections should be regarded as a lower and upper interval limit of possible resource availability and that they exclude any influence of the potential competition for the resource. The conservative projection represents potential business development under current circumstances and is therefore attainable without major regulatory changes. Whereas, the optimistic projection of resource availability could potentially become attainable sometime in the future if (and these are not all constraints):

- 1) certain regulatory provisions and sustainable forest management planning prescriptions are modified (e.g. incorporation of new evidence on volume MAI rate in tōtara-dominated stands),
- 2) processes concerning the preparation of sustainable forest management plans and permits are simplified,
- 3) high land-owner engagement can be maintained via economic and other incentives, and
- 4) active management of naturally regenerated indigenous forests is deemed acceptable by the local communities and society in general, which would ensure long-term access to sufficiently-sized forest areas and improved log quality.

Hence, the main purpose of the optimistic projection is to identify the potential size or scalability options for this specific industry in Northland.

Both scenarios share most of the inputs, however, some of the costs (e.g. salaries and other staff costs, equipment costs) that relate to the total volume processed are different. The biggest equipment investment in both scenarios represents the purchase and instalment of drying kilns, followed by specialised harvesting equipment (e.g. small forestry skidder/modified agricultural tractor and logging winch – e.g.: <http://www.bijol.eu/en/bws-160-en>; https://uniforest.com/products/forestry_winches/profi/winch_heads/117/nadgradnja_gozdarskeg_a_traktorja/; <http://www.vitli-krpan.com/en/sales-program/forestry-winches>; <http://www.tajfun.si/vitli/index.html>) in the case when harvesting operations (i.e. tree felling and extraction) are not contracted. Please note that the capital investment for the kiln equipment we used as an input in the financial model does not include the energy source purchase (e.g. wood waste boiler) – developed scenarios assume that the dedicated kiln(s) would be based at a location with existing energy source facilities.

Using the PwC model and defined inputs, we produced a set of different modelled results (discounted cash flow analysis) that are presented in Table 3. There are over 50 inputs for the financial model. Main inputs that vary between different scenarios are:

- resource availability – log volume (conservative and optimistic),

- some of the annual fixed costs (e.g. salaries, other staff costs, equipment investment) that are dependent on processed volume,
- arrangement of tree harvesting and extraction operations (contractors versus in-house silviculture/harvesting crew and equipment)
- timber price (weighted average value of \$2200/m³ and \$1800/m³; the latter represents the case if the proportion of poor quality trees/logs is higher than what we have encountered in our project trial harvests), and
- discount rate (8% versus 5%).

Please note that all the presented scenarios assume no stock-piling, all timber produced is sold within one year, and there is no revenue from or cost of disposing of waste material at the sawmill. Current scenarios assume that following personnel would be employed: a CEO, marketing and sales person, forest manager, and silviculture crew staff (if harvesting and extraction is not contracted). Their FTEs slightly vary between different scenarios because of the differences in the processed volume.

It is essential for the entity to have access to dedicated kilns due of the longer timber drying schedules for tōtara, compared to radiata pine. The easiest solution for this is investing in one's own kiln infrastructure and leasing it out to other users during periods when it is not fully utilised.

The financial model results suggest that this investment will not have negative effects on the financial viability of the business.

One of the key findings that has come out of this work is that it would be very beneficial for the entity to employ its own silviculture/harvesting crew. Besides conducting the tree harvesting and extraction, this crew could be involved in other tasks related to sustainable forest management, such as: forest tending operations, inventory and forest management planning tasks, and land owner engagement.

While this would have significant positive effects on the business from the financial perspective, it would also provide the much-needed certainty around quality of the forest operations and resolve potential unavailability of suitable contractors and machinery. More importantly, it would be aligned with project's kaupapa by building capability within the local communities. Expert knowledge and experience that is needed for continuous cover forestry regimes, especially for selective harvesting and extraction operations, is currently lacking in New Zealand. Therefore, developing professional staff with such skills will be advantageous for the future entity. All the evidence collated and financial model results (discounted cash flow analysis) indicate that this is a viable business proposition. Although it is likely to be of smaller scale in the beginning than originally anticipated and of slower growth, it certainly has the potential to be quite profitable, yielding high internal rate of return – see Table 3.

Note that this model has not included the cost of building of tracks within the stands to remove trees in the centre of a stand, as the costs would be impossible to predict at this stage. These costs are likely to be needed within the model's 30-year timeframe.

Table 3. Financial model results (net present value – NPV and internal rate of return – IRR) with a range of scenarios that vary log volume, discount rate, weighted wholesale timber value and other operational conditions

SCENARIOS																																	
Present value (\$000s)	Year count																																
#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	NPV (\$000s)	Comments	IRR
1	-1429	-480	123	394	161	381	407	441	472	455	538	213	604	633	624	688	698	723	751	753	508	747	752	774	782	661	844	866	888	15910	29884	>> conservative volume, without the silviculture crew and equipment	28.1%
2	-1449	-501	132	434	183	445	489	545	600	595	724	294	859	926	939	1065	1110	1184	1265	1304	906	1370	1417	1501	1559	1357	1781	1880	1981	71279	96174	>> as #1, required return reduced to 5%	28.8%
3	-1591	-339	409	511	361	589	625	667	707	698	790	473	873	910	909	893	967	1004	1042	1054	819	1068	1082	1115	1080	1003	1197	1231	1263	22849	44259	>> conservative volume, includes dedicated silviculture crew and equipment	35.0%
4	-1613	-353	439	564	410	688	750	824	898	913	1062	654	1241	1331	1368	1382	1540	1643	1754	1825	1458	1957	2040	2162	2153	2057	2525	2670	2819	102255	139417	>> as #3, required return reduced to 5%	35.3%
5	-1448	-507	87	476	126	1272	1485	1529	1578	1181	1685	1697	1749	1798	1511	1899	1947	1993	1788	2052	1929	1773	2018	1864	2070	1969	2172	2072	2123	40859	82746	>> optimistic volume, without the silviculture crew and equipment	42.7%
6	-1468	-529	93	526	143	1485	1784	1888	2005	1544	2265	2346	2487	2630	2274	2939	3099	3262	3011	3554	3437	3250	3804	3613	4127	4039	4581	4496	4738	182354	253776	>> as #5, required return reduced to 5%	42.8%
7	-1610	-366	373	807	673	1717	2022	2088	2156	1779	2302	2333	2295	2434	2169	2578	2647	2714	2453	2789	2689	2556	2762	2671	2901	2773	3033	2913	3019	57435	117107	>> optimistic volume, includes dedicated silviculture crew and equipment	52.5%
8	-1633	-382	400	891	764	2005	2429	2579	2740	2325	3094	3225	3263	3560	3263	3989	4213	4444	4131	4830	4791	4684	5207	5178	5785	5687	6400	6321	6739	256339	357262	>> as #7, required return reduced to 5%	52.5%
9	-1680	-599	-35	182	31	342	326	305	337	321	406	81	473	502	493	469	534	562	591	594	364	604	610	633	588	501	685	709	731	13076	22734	>> as #3, weighted average value of timber price reduced to \$1800/m3 (represents the case of poor tree/log quality)	22.3%
10	-1699	-626	-71	432	46	898	1176	1225	1276	881	1386	1398	1342	1462	1177	1566	1615	1662	1380	1694	1607	1452	1637	1522	1730	1578	1815	1670	1752	34159	67143	>> as #7, weighted average value of timber price reduced to \$1800/m3 (represents the case of poor tree/log quality)	35.0%

Revision of the business case

Summary of original Business Case (extracted from Project Initiation Document):

The costs for the two-year pilot project was estimated at \$1 million total investment. There may be further investment required for the future operation to cover the CEO and other required staff.

The benefits were conservatively calculated as \$7.5 million in revenue from tōtara timber per year within three years of developing an industry within Northland. If that timber is manufactured into high-value wood products, such as furniture and interior fit-outs, the potential value increases to \$40-\$60 million per year (New Zealand-wide).

Note the above figures were based on the bigger land area of native bush containing tōtara (200,000 ha), rather than tōtara-dominant stands and thus the timber volumes that this early financial model used were much larger (starting from 10,000 m³ and growing to 57,000 m³) over the first 10 years of operation.

Revised Business Case:

The project investment was actually \$1.1 million and there was no ability to engage or hire a CEO or Commercial manager as anticipated prior to the project start (due to limited funds and lack of clear future pathway until much later in the project). Note that there was no intention of providing permanent jobs as part of this pilot study.

There were many assumptions in the early benefit estimates as the resource availability, log to lumber (and grade) recoveries, sawing and drying costs as well as price point in the market were all largely unknown. Some of these values are much better known now or able to be more accurately estimated, and so the benefits and timing has also been revised, with the information gathered to date.

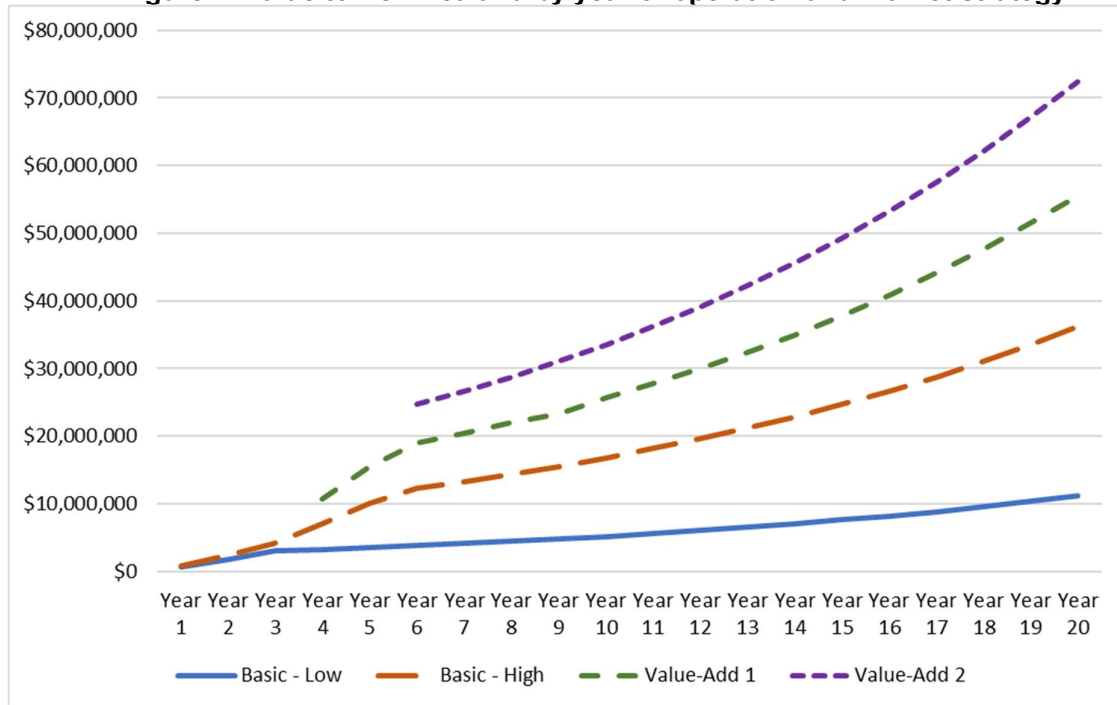
Based on the evidence gathered, we prepared two different scenarios, i.e. conservative and optimistic projection, for the volume of the tōtara resource. The main difference between the two scenarios is the mean annual increment (MAI) rate used for determining the allowable harvest intensity in managed forests, i.e. 1 m³/ha/yr versus 3 m³/ha/yr. Currently, values closer to the former value are being used in the permitting process administered by Te Uru Rākau (MPI).

In the conservative scenario, it is predicted that timber volumes would start at much lower levels, compared to the original (proposal) business case, and grow to around 2,300 m³ (log volume ~4,500 m³) by year 10, for the initial phases of the commercial operation. These values are impacted not only by volume of resource available via current permitting calculations and land area of tōtara-dominant stands but also start-up and operational logistics. This operation is deemed to be a long-term and sustainable prospect and therefore we have extended the timber volume projections out to 30 years, by which time we think it could build up to around 11,000 m³ timber volume per year (log volume ~21,000 m³).

Conservatively estimated timber volumes are now projected to rise from <1500 m³ over the first 3 years to 2,300 m³ by year 10, 3,450 m³ by year 15, and up to 11,000 m³ by year 30. Based on these revised timber volumes per year, revenue starts lower and grows more slowly compared to the original business case. By year 3, revenue within Northland (to TIP entity; i.e. from wholesale price ex-mill) would be around \$3.0 million per annum and grows to \$3.5 million by year 5 (assuming all timber is sold each year, with no stock-piling). By year 10, revenue would have grown to \$5.2 million per annum.

The New Zealand-wide value includes all manufacturing, some of which is not currently available in Northland. Figure 1 illustrates four different strategies of value across New Zealand over time.

Figure 1. Value to New Zealand by year of operation and market strategy



Key:

- Basic - Low uses the lowest weighted average for manufactured product (estimated \$2200/m³ retail), the lowest volume (no changes to tree growth rate, MAI of 1m³/ha/year), no value added
- Basic - High uses the higher weighted average (\$3000/m³ retail), the higher timber volume (tree growth rate increase to MAI 3.1), no value added.
- Value Add 1 uses higher timber volume and weighted average with 50% basic strategy and 50% value-add of medium value (\$6200/m³ retail)
- Value added 2 uses same as 1 for basic strategy but at 75% of timber volume, with 25% value-add of 5 times value per volume (\$15,000/m³ retail, the higher of the value-added options)

The following figures based on the optimistic (high) projection of the tōtara resource should be used with caution, as they are tentative and provide an upper estimate of the potential size of the business. In contrast to the conservative estimate, the optimistic scenario projects that the timber volumes could rise more quickly and go higher, i.e. from <1500 m³ over the first 3 years to 5,600 m³ by year 10, 8,200 m³ by year 15, and up to 26,000 m³ by year 30. Such timber volumes would yield by year 3, a revenue around \$3.0 million per annum that would grow to \$7.4 million by year 5 (assuming all timber is sold each year, with no stock-piling). By year 10, revenue would grow to \$12.3 million per annum.

For calculating these revenue figures, we used a weighted average wholesale price (all grades per volume) of \$2200/m³, which is the selling price of the timber from the “TIP” entity to the timber merchant or manufacturer. We have received offers of \$2000/m³ for the lower and middle grades of timber from several companies interested in the project timber (in contrast, the 2015 PwC model, the lowest grade (box) was assigned a value of \$400/m³). Clear heartwood boards command the highest price of >\$3000/m³. In the full revision of the original PwC financial model, we looked at how this weighted average price point changed the financial viability as part of a sensitivity analysis, and the result was that all these scenarios were financially viable from an operational point of view (not considering market demand), but the scale was smaller and thus benefits were lower.

The market price point of the final product will be higher (in Figure 1, these retail prices range from \$2200 to \$15,000 /m³) and depends on the specific product and level of manufacturing required. Value will also be accrued to the manufacturers, as illustrated in Figure 1.

There are implications of these changes impacting the extent of this business in the early stages, as it would involve lower revenue and fewer permanent jobs compared to the original estimate in the first ten years. However, based on the financial model results, profitability and investor payback could be reached relatively early (potentially at year 3).

There are also many environmental benefits that would result in supporting and encouraging this sustainable and regenerative land use, weaving more native forest and resilience into the rural production landscape, as well as cultural values. These positive outcomes have not been quantified or accounted for.

Business advice and proposed models

Business advice was contracted as the skills, availability and expertise was not present among TIP project partners. Therefore, the company called Spring was contracted in two stages and provided tailored business advice that covered a high-level market scan and business case of selected opportunities, including recommended business structures and next steps towards implementation. The brief given to Spring was to maximise the value per timber volume and for the region and within New Zealand, including the other aspects of the kaupapa.

Summary of the high-level market scan

The key findings from the Market Scan stage by Spring were:

- As a pure timber play with sale prices of between \$1,000 and \$3,000 per m³ it is a relatively small business opportunity generating no more than \$12 million industry revenue per annum in 10 years' time, based on the optimistic view of available timber volumes.
- The key to higher prices is accessing the uniquely decorative sectors, especially decorative linings and carved items.

Given the size of the New Zealand economy, a significant majority of the volume of product produced in these sectors needs to be exported or bought by international tourists, in order to achieve greater sales values faster, thereby creating a more viable business opportunity. The principal export opportunity is with value-added product into the linings market in commercial construction. There is also a meaningful opportunity to establish a carving proposition aimed at international tourists. But, in both cases, the goal is to have tōtara sold to market customers that are based offshore.

Summary of Business Case findings

Both industry propositions were explored based on the direction set by the Spring Market Scan, with a strong focus being given to the decorative linings in the construction industry, and a lesser focus on the carving opportunity in the tourist sector.

The key focus areas were:

- **Business model options** – assessing alternatives and proposing a preferred model that is resource-led through a co-operative ownership model
- **Value chain implications** – estimating how value would be shared amongst the participants from grower to distributor (final position prior to end-user)
- **Market sizes and revenue potential** – estimating the growth rates and scale based on both market opportunity, but with reference also to the available volume of supply
- **Roadmaps** – identifying the key steps needed to be undertaken based on both the decorative linings and carving opportunities.

Following the analysis, our conclusions and estimates of potential value were:

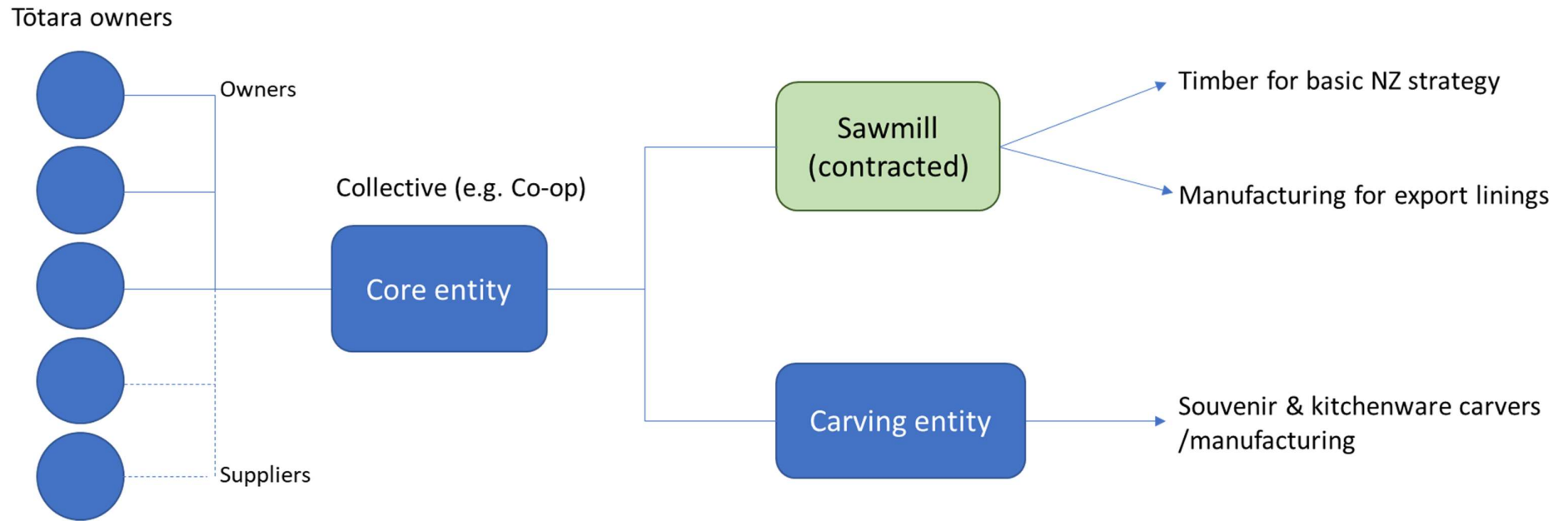
- There are two distinct product types worthy of detailed market investigation in the decorative linings market – a solid wood product and a veneer covered panel product.
- There is also the potential for a significant carving market for souvenirs and “featureware” kitchen/serving items based on a strong tōtara brand story and highly commercial execution across the value chain.
- A co-ordinated resource-led business model led by a co-operative company of growers provides a mechanism to manage the value chain for both of these market opportunities (see Figure 4).
- There are potential revenue returns available at the milling stage through wider value chain participation, after the eighth year of each markets’ respective development, of:
 - Decorative Linings: \$11.5 million per annum for 3,013 m³ of tōtara timber input. This would double the revenue pa compared to the basic NZ strategy.
 - Carving: \$8.7 million per annum of revenue for between 763 and 2,289 m³ of tōtara timber, depending upon the market positioning strategy chosen. This would represent between 3 and 5 times the revenue pa compared to the basic NZ strategy.

The advantages and disadvantages of the various types of business models were outlined and discussed with the resource-led model being deemed to be the most suitable. Figure 4 shows this model with the Cooperative structure as one example of a vehicle that could give effect of collectivising the resource as required.

Some elements of the supply chain could be contracted by the Cooperative, such as processing (milling and kiln-drying). From a community benefit viewpoint, as much of the value chain that can be controlled and conducted within the region (if possible) or New Zealand, delivers the most value locally. This aspect is a key part on the TIP kaupapa to encourage local participation and capacity, and to retain wealth in the region.

A market-led financial model that allowed different product mixes and targeting of different markets to be developed over time was also provided as a tool. This model can be run for different value-added products separately for an 8-year timeframe.

Figure 4: Diagram of proposed business model (by Spring, 2020)



The business advice delivered during this project is considered to be the first piece of work, with more targeted work required in the next phase of this initiative. Further work would include:

- **Key business partners.** We need to identify and bring together key business partners and potential investors. This will include landowners, timber processors and potential manufacturers within Northland and more widely in New Zealand. This process has started with the stakeholder engagements conducted in the latter half of the project. In particular, several Māori groups have indicated their support for this opportunity and their desire to be part of driving this forward, as fits with our kaupapa.
- **Detailed business plans:** This will include scoping the key aspects of the business venture and producing detailed business plans for the selected product opportunities.
- **Agree strategy and implement plans.** With the engaged business partners, the business structures will then be formed, and the business plans implemented.

Some of the key elements of these business plans have already been provided, as part of the road maps to developing the various value-added opportunities. These include:

- Explore how to develop the principles and mechanisms required to secure the resource (consult with engaged landowners) with the recommended business structure of a resource-led value chain.
- In the proposed set-up phase, some tasks that need to be implemented prior to commercial operations were:
 - Formation & leadership (of structure and establish key contractual relationships)
 - Commercial model (agree revenue sharing model and supply versus own rules), and
 - Government relations (lobby for change for export opportunity).

Key findings: Financial and Business models

- Analyses indicate that there is a viable business opportunity based on farm-tōtara growing in Northland, even with lower than predicted timber volumes initially.
- Gathered evidence suggests that early projections of resource availability were overly ambitious. A crude estimate of area of the existing tōtara *dominant and merchantable-sized* resource is 26,500 ha, which is a subset of the land area than what was used for the original business case (200,000 ha). However, tōtara is present within much of the 200,000 ha and may add to the future available supply. The fact that the currently available resource is smaller does not have overly detrimental effects on viability of the business case; however, the initial business will need to be of smaller scale than what was initially anticipated.
 - Results suggest that by the end of the first decade the processed annual log volume of tōtara resource could be ~4000 m³, with the potential to increase up to ~20,000 m³ by the end of the thirty-year period.
 - Full revision of the PwC financial model had to be undertaken to accurately assess the viability of the business opportunity – most of the original assumptions were modified.
 - All the evidence collated and financial model results (discounted cash flow analysis) indicate that this is a viable business proposition; though it is likely to be of smaller scale in the beginning than originally anticipated and of slower growth, it certainly has the potential to be quite profitable.
 - It would be very beneficial for the entity to employ its own silviculture/harvesting crew; both from economic, logistic and community perspective.
 - Based on the financial model results profitability and investor payback could be reached relatively early (potentially at year 3).
 - By year 3, revenue would be around \$3.0 million per annum and grows to \$3.5 million by year 5 (assuming all timber is sold each year, with no stock-piling). By year 10, revenue has grown to \$5.2 million per annum (using the conservative timber volumes).
- The high-level market scan and analysis of global market sizes resulted in the identification of two product opportunities that would fit the farm-tōtara timber: decorative interior linings and carvings.
- The business cases for each of the selected opportunities would be slightly different in the arrangements required along the value chain and where the value would sit, but both would involve a resource-led entity that would be the conduit for all the farm-tōtara delivered.
- The proposed business structure would focus on the securing the resource, with the formation of a Cooperative structure (or similar vehicle) to ensure there is sustained access to farm-tōtara.

National context for indigenous forestry

There is a wider national context that this project sits within that presents both risks, threats and opportunities, as well as other projects being conducted that support the outcomes of this work.

Te Ao Māori

As a publicly-funded initiative, with Te Taitokerau Māori Forestry Inc. in the partnership, the Steering Group of the Tōtara Industry Pilot chose to adopt best practice and a shared values approach by making space for tikanga Māori (customary values and practices) so local Māori worldviews and customary interests would be integrated into the project and acted upon. These contextual arrangements resulted in the Steering Group adopting a kaupapa (mission) that enshrines both Te Ao Māori and non-Māori values and aspirations to drive strategic intent.

The approach recognised the constitutional significance of (indigenous) forests and taonga being named in the Second Article (of the Treaty) and guaranteeing Māori signatories would retain the possession and enjoyment of these treasures under Crown rule. The way that Māori land is defined under various legislation⁴, stating land that is held by Māori in accordance with tikanga Māori, shall have the status of Māori customary land. Further, the Resource Management Act 1991 (Section 6(e), a companion of the Forests Act 1949) mandates decision makers 'recognise and provide for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wahi tapu [sacred sites], and other taonga' as a matter of national importance.

The Wai 262 claim, a precedent-setting Waitangi claim now used to test customary rights relating to the natural environment, also has clear relevance here. A claim that considered who is entitled to make or participate in decisions affecting indigenous flora and fauna, the environment, Māori culture and the products of Māori culture, although yet unsettled, has implications that will change Crown agencies, policies, regulations, and sectors in the years ahead. As Government creates, implements and oversees its business, it has the express responsibility through its constitutional arrangement under the Treaty to ensure that Māori rights and interests be honoured. The Waitangi Tribunal issued a response to this claim in 2011 in a report, *Ko Aotearoa Tenei*, by acknowledging contemporary laws had fallen short of protecting and expressing the rights of Māori to taonga. Recommendations were also made for law reform, policy, and practice of publicly funded areas including science, and intellectual property; and an evolution of the Crown-Māori relationship into a 21st century relationship of mutual advantage in which, through joint and agreed action, both sides end up better off than before they started.

On 28 August 2019, Minister for Māori Development, Hon. Nanaia Mahuta announced the Government's potential Wai 262 work programme at the Iwi Chairs Forum in Heretaunga. A whole-of-government response to Wai 262 is currently being developed.

The Tōtara Industry Pilot presented an opportunity to renew how Māori can be positioned to better protect taonga species, taonga works and indigenous knowledge (mātauranga Māori) to recognise and leverage these opportunities in a manner that prioritises Māori aspirations.

Under the Wai 262 test, a Treaty-compliant regime should deliver control by Māori if the kaitiaki interest in taonga is given priority; partnership if kaitiaki should have a say in decision-making but other voices should be heard; and have effective influence in all areas of management.

Clearly, unless adequate and appropriate provision for the whakapapa interests of kaitiaki were identified in the Pilot and put in place in a future industry Māori interests would rightly contest a start-up. A series of virtual stakeholder briefings were held with Northland landowners including

⁴ The Forests Act 1949 (the legislation that guides sustainable forestry management) by Te Ture Whenua Māori Act 1993 (Māori Land Act 1993)

whanau, hapu and iwi during Covid-19 lockdown to interrogate a future tōtara industry in Northland. The feedback from those sessions presents Māori-specific questions such as: access to and growth of tōtara resources on Māori customary land, a business model and structure that supports diverse interests, a brand-provenance strategy for a taonga species, and how benefit would flow into the rural and cultural communities.

Learnings from the mānuka industry were also discussed and considered in respect to not only Northern Māori interests, but also national Māori interests in tōtara as a taonga species, in a future export-focused industry.

For these reasons, a series of wānanga to discuss the interests of Māori in a tōtara industry are being planned as the first step in the next (pre-commercialisation) stage.

Other projects

This TIP project is supported by complementary work and projects being undertaken by the project partners and other individuals and organisations. These include:

- **Our Forests Our Future** is a three-year Tane's Tree Trust project funded by the Tindall Foundation that includes a work stream "building on the Northland tōtara work". This co-ordinates the Northland Tōtara Working Group (NTWG) work, and engages with Te Uru Rākau on trialling and improving approaches to SFM Plan and Permit application processes, promotes the management of regenerating native forest, submits on relevant legislation, and initiates projects to undertake complementary research work (for example the re-measurement of the network of Permanent Sample Plots in regenerating tōtara stands on private land). It also supports complementary research on tōtara conducted by others such as Scion and DairyNZ (see below).
- **Productive Riparian Buffers**, is a project run by NIWA and DairyNZ. One part of this project is exploring the potential to manage tōtara on farms for multiple uses. Of particular interest is the investigation of essential oils from the foliage that could be harvested from silvicultural tending. The NTWG are facilitating the field harvests for this project.
- **Remeasurement of tōtara PSPs**. Tane's Tree Trust will be remeasuring their network of 60 existing Permanent Sample Plots (PSPs) in tōtara stands. This will yield valuable information on growth rates and responses to various silvicultural treatments (thinning schedules). This will improve regional modelling of tōtara growth rates and productivity.
- **Tōtara Management Manual** (project pending). Tane's Tree Trust have a project proposal to Te Uru Rākau to develop a practical field guide for landowners on managing tōtara on private land. It would cover planting, natural regeneration, pruning, thinning, harvesting and consenting processes etc. and assist landowners nationwide with the sustainable management and development of their tōtara resource.
- **Tōtara plantation research**. Scion Core Funding (now SSIF) has been used to initiate remeasurements of planted tōtara on "greenfield" sites and in areas where a nurse crop pre-existed or was planted. Results from these assessments will be available post July 2020. We have also obtained increment core samples from both planted and natural stands of tōtara to develop models of wood density and heartwood content. Heartwood content in relatively young tōtara is difficult to predict and identify with any precision. The results from these studies have been published in the New Zealand Journal of Forestry.
- **Model for predicting volumes of farm-tōtara**. Scion has also used the metrics from harvested TIP logs to begin developing a model to support estimates of standing volume for tōtara. Currently Te Uru Rākau specifies the use of the rimu volume equation as a robust model specific to tōtara does not yet exist.
- **Durability testing**. Scion has separately initiated the establishment of long-term durability testing of farm-tōtara to investigate the outdoor performance (above-ground) over 15 years.

- **Extractives and residues.** Studies at Scion are ongoing to attempt to develop a chemical characterisation of heartwood and correlate it with colour changes found within the stem.
- **One Billion Trees Programme.** This Te Uru Rakau administered government initiative is encouraging the planting and natural regeneration of new native forest areas. Manuka with tōtara as an associated canopy tree species, is a popular choice of species mix. The successful establishment of a tōtara industry will encourage further plantings, which in turn will eventually also become a potential supply for the industry.
- **The Northland Regional Afforestation Strategy (by the Northland Regional Council (NRC)).** Considerable areas in the Northland region will be increasingly targeted for a change in land use from pastoral farming to afforestation by the NRC. Developing tōtara forests on private land and continuous cover forestry options are being encouraged by the Councils' land management team.
- **The Kaipara Harbour Remediation project** – a government and dual regional council environmental project, with a vision that includes riparian planting and >1,000ha of afforestation in the Kaipara catchment, including areas of highly erodible soils, where native forest and continuous cover forestry is likely to be a preferred land use option.

All of the above work supports and complements the TIP project or any future tōtara industry that arises.

The potential for legislative or regulatory changes is another important part of the present context. This includes recent and current documents such as the National Policy Statement on Indigenous Biodiversity and coming district plan revisions. Forestry is a long-term investment and inevitably spans many potential regulatory reviews that could be associated with significant implications for business activities. Naturally, such future changes are unknowable and that adds insecurity for any potential industry. In this case, legislative changes could potentially result in significant impact to a future tōtara industry by restricting access to the existing tōtara forest resource and/or affecting the viability of a sustainable harvest operation by costly consenting processes etc.

At this stage, such insecurity is associated and foreseeable with the following:

- The Draft National Policy Statement on Indigenous Biodiversity (submission closed 14th March 2020).
- Any potential review and amendments to the Forests Act, and/or the Resource Management Act
- Every 10-year review cycle (or challenge) to regional and district plans.
- Health and Safety legislation that restricts manual tree-felling and extraction
- A New Zealand Forest Strategy
- Procurement policies that require third-party accreditation (e.g. FSC etc.) N.B. – It is unviable for small forest owners to participate in such schemes.
- Bio-security measures (e.g. Kauri die-back & Myrtle Rust)

Engaging with policy makers and administrators and submitting on all relevant documents when opportunities arise will be essential to protect the interests of any future tōtara industry.

Issues and risks

A risk register was set up at the start of the project from a technical delivery point of view. Mitigation actions were planned and implemented. After the first formal governance meeting of the project (May 2018), these technical risks were consolidated and other types of risks to the long-term goals of the initiative were considered. Risk heat maps were produced at the technical and consolidated strategic level, and reviewed and updated quarterly or as required.

Over the duration of the project, two technical risks were closed (timber mill unable to mill to requirements and unable to engage with manufacturers to check price point of project timber), as they were deemed to have been so reduced to be very unlikely to be realised as an issue.

Another risk became an issue (delays from permitting & planning processes), where the long time required to achieve permits delayed the Stage 2 harvest to outside the timeframe targeted (January to March 2019). Several actions had been implemented to mitigate this risk but were ultimately unsuccessful in obtaining permits more quickly, despite the best efforts of all those involved (including those in MPI/TUR). This risk/issue was present in both technical and consolidated risk heat maps. More work is therefore required to reduce the impact of this on-going issue.

Examples of the consolidated risk heat map is given in Figures 5 & 6 (Sept 2019-Feb 2020 and narrative) and Figure 7 (July 2018, first consolidated heat map), with further risk heat maps through the project given in Appendix 4.

Figure 5: Risk Heat map - September 2019 to February 2020

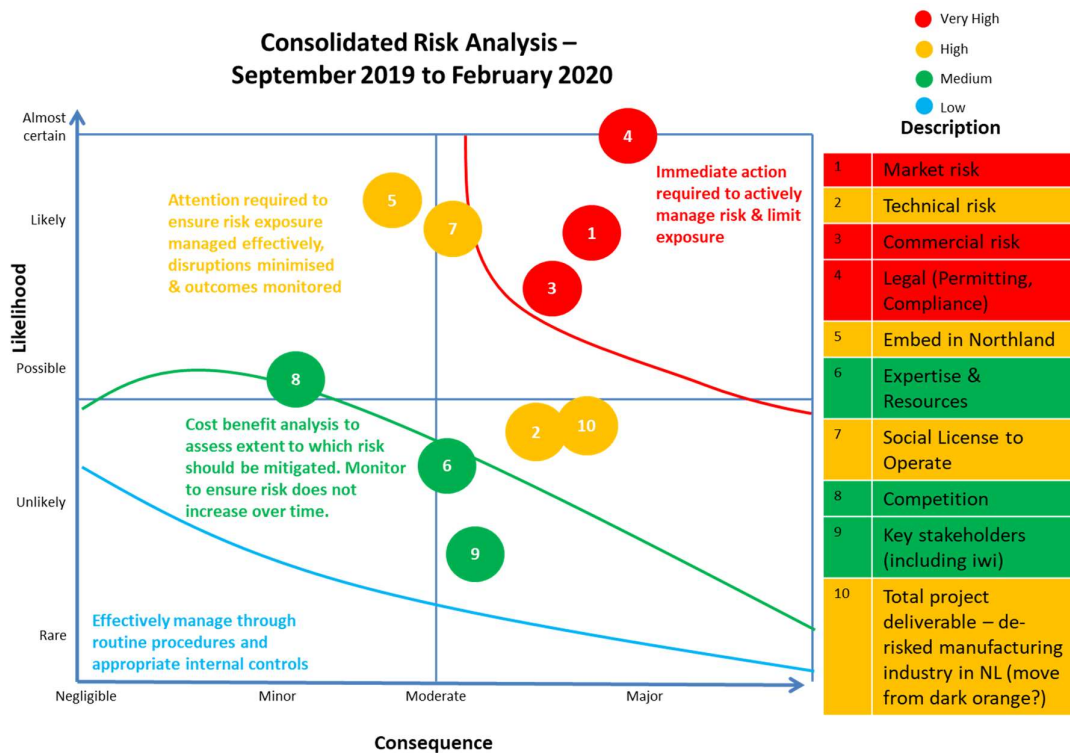
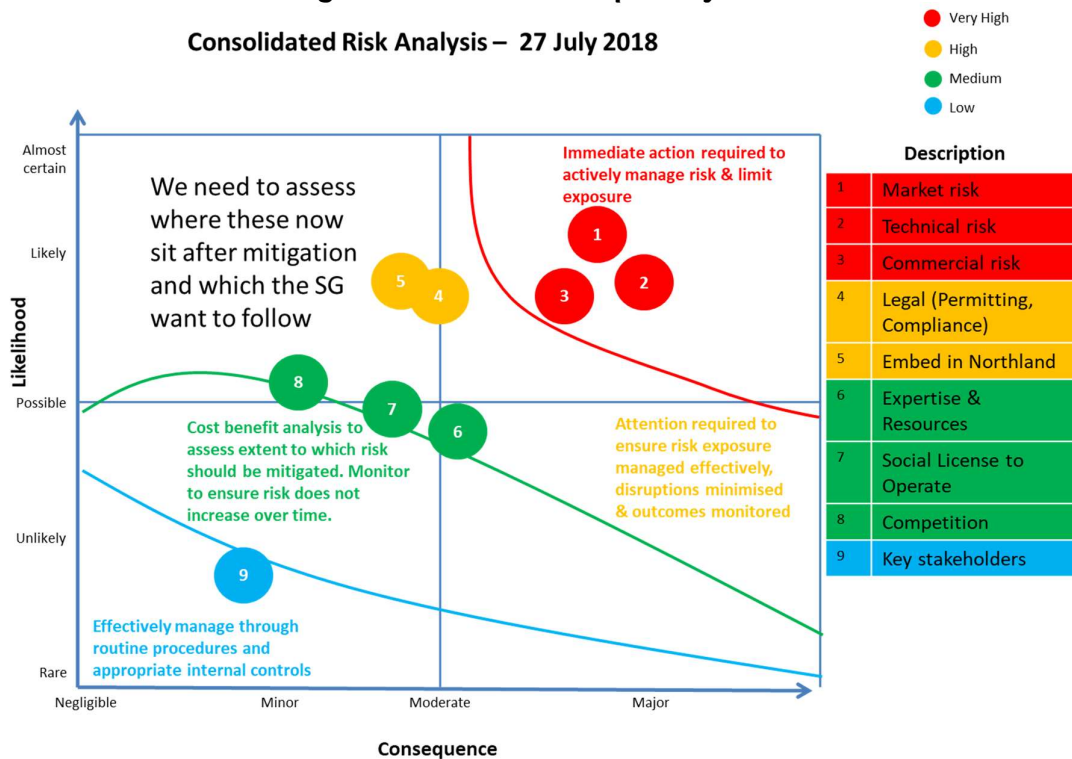


Figure 6: Narrative of Risk Heat map - September 2019 to February 2020

Risk	Narrative	Change
Market risk	One of the key risks identified at the beginning of the programme an important part of the programme. This work is in progress but not completed	No change yet
Technical risk	This includes ability to harvest, mill, dry and machine the timber. This work is in progress and to date we have not encountered show stoppers.	No further change
Commercial risk	Testing that we can develop a viable enterprise, secure the yields we need and produce marketable timber in the context of a sustainable business with its own distinctive value proposition.	No change yet
Legal	Ensuring that we meet the Forest Act and do not breach any other legislative requirements. We can meet requirements but timing still challenging for operational delivery.	No further change, future focus
Embed in Northland	The translation into Northland activities and also building capability in Northland is a key part of the programme. Difficult to engage others (students), need for training	More work to be done, close attention required
Expertise & Resources	We have the current skill set to address the immediate project needs. This will be tested as we translate into more market focused activities.	Close attention required
Social License to Operate	To date we are securing excellent support but focus on this must increase. Previous conversations with some Northland iwi suggest that we need to ramp up the focus on communication. Not yet fully implemented and increasingly important	More work to be done, close attention required
Competition	Close followers destroying our value proposition and reputation risk.	Close attention required
Key stakeholders	Includes MPI, Te Uru Rakau, DoC, MfE, Regional Councils and any others who can positively or negatively influence the programme.	Close attention required
Overall project deliverables	De-risked manufacturing industry in Northland	Moved down (Sept 19) close attention required

Figure 7: Risk Heat map - July 2018

Consolidated Risk Analysis – 27 July 2018



Next steps and Recommendations

Next steps for the TIP Initiative beyond this project:

The next phase for TIP (pre-commercial). Due to the positive results of the current project, this opportunity should be pursued. There will be one final phase to enable commercial industry start-up. This will include several key pieces of work (shown below) and continuing to mitigate some of the remaining risk (such as market demand, landowner engagement and increasing legal license to operate). The drafting of this next plan has already started.

There are a number of pieces of work that are needed to provide more detailed plans as well as starting to form key partnerships, alongside addressing residual risks and extend the potential value from the opportunity.

The specific pieces of work include:

- **Key business partners.** We need to identify and bring together key business partners and potential investors. This will include landowners, timber processors and potential manufacturers within Northland and more widely in New Zealand.
- **Detailed business plans:** This will include scoping the key aspects of the business venture and producing detailed business plans for the selected product opportunities.
- **Agree strategy and implement plans.** With the engaged business partners, the business structures will then be formed, and the business plans implemented.
- Some of the above details have already been provided in the results of the preliminary business advice already received. These are:
 - Explore the principles and mechanisms required to secure the resource (consult with engaged landowners) with the recommended business structure of a resource-led value chain.
 - There are more items provided in the road maps of the preliminary business cases in the proposed set-up phase (T0 phase) from Spring that provides some detail of tasks that need to be implemented prior to commercial operations:
 - Formation & leadership (of structure and establish key relationships)
 - Commercial model (agree revenue sharing model and supply versus own rules)
 - Government relations (lobby for change for export opportunity)
- Some activities started in the current project will need to be on-going. These include:
 - Stakeholder engagement which will provide input into the above. This will include community groups in Northland and more widely in New Zealand.
 - Selling the project timber and continued seeding of the market, including promotion of the timber, and provision for continued supply.
 - Other operational activities such as maintenance of website, response to enquiries and receiving revenue from timber sales.

As part of moving to the next phase, there will need to be a move away from the current governance and operational structures that have been suitable for a feasibility study involving several project partners, including some government agencies. A move towards more commercially relevant governance structures with more industry partners to effectively guide this next pre-commercial phase is required. Planning to ensure smooth transitions from one structure to the next is underway so that there is limited or no disruption to the work program of the next phase.

Recommendations:

Secure funding for this next phase as a matter of urgency.

Options are MPI's Sustainable Food & Fibre Futures Fund (SFFF), MBIE (Māori Innovation Fund – Commercial Advisers scheme), PGF II (Whenua Māori) or direct investment from potential owners.

The first option (SFFF) mentioned has been assessed as being a good fit with alignment in objectives and outcomes but the requirement for significant co-funding will need to be addressed. There is the potential collateral from timber sales revenue as co-funding, but much of this is yet to be realised.

As this development moves towards the commercialisation of the opportunity, the need to provide sufficient detail in a prospectus to engage effectively with potential investors will be addressed in the transition from a feasibility study to a pre-commercial implementation plan.

In recent stakeholder engagement, some parties were expressing interest of being partners in this next phase, but suitable materials such as a prospectus do not yet exist. So, there have been potential partners starting to be identified from the project operations, which is encouraging, but as yet still no business entity for them to participate in.

It might be that the content of the next phase plan indicates a move away from utilising only governmental funding mechanisms to having more commercial investors. However, this could lead to a longer delay in the start of the next phase while the funding is secured from multiple sources.

Engage a commercial manager who will lead this next phase of commercial implementation. One identified leader with relevant commercialisation experience is needed to drive this next phase. This is required to align with the development phase and to stream-line operational decision-making on a more commercial basis. A draft position description has been written and will be further customised to reflect the current draft plan for the next phase.

Potentially conduct a **more accurate assessment of tōtara resource in Northland**. The most promising solution for resolving the uncertainty around tōtara resource availability is utilisation of remote sensing inventory techniques, e.g. a LiDAR dataset for Northland region. To obtain a reliable estimate of the resource and future supply potential the entity will have to wait that the LiDAR dataset for Northland region becomes available. This may be part of a related project designed to support the objectives of the TIP initiative, rather than part of the pre-commercial work plan. It is not known if a more accurate inventory of the tōtara resource will increase confidence in supply as the volumes projected to be required in the initial phase are lower than originally anticipated and still remain a viable business opportunity.

Explore opportunities that exist to develop additional benefit. In particular, a range of by-product streams were identified during the project as being worthwhile to explore but fell outside the scope of the project.

For example, tōtara value chain analysis to investigate the potential of non-timber products made from tōtara (for example, extraction of essential oils and other chemicals from bark and branches).

Other opportunities include deriving value from the seeds, fruit, leaves and other non-timber aspects of the trees. Development in these areas would of necessity include the local landowners and iwi groups, to potentially develop seed banks, use for food, in combination with traditional knowledge of usage for the different parts of the tree. This would increase the holistic approach within our kaupapa and continue to increase knowledge and value to enhance native forest stands within the Northland landscape.

Operations of the Pilot Project

Finances

Project finances were reported to the Steering Group quarterly and monitored monthly. Additional funding was obtained from the Pre-Seed Accelerated Funds, PSAF (Scion's allocation) of \$100,000 (as there were funds in that pool that were required to be used by June 2019), making a project total of \$1.1 million over the project timeframe. A budget revision was conducted in September 2019 to ensure that the funds were prioritised to the key remaining tasks. As expected, the small contingency was drawn down during the course of the project.

Estimating the cost of conducting tasks for the first time will always be subject to change over time and it is clear the list of project tasks was ambitious for the funding secured. Therefore, the funds were prioritised to addressing the key technical risks (forest harvesting and timber processing), with less funds being allocated in the end to the Market & brand development, and Enabling Environments (LTO) work streams.

Over the Project life, all the funds were used, with a final balanced budget delivered.

These funds came from the following mechanisms:

- Scion's allocation of PreSeed Accelerated Fund (PSAF) \$400,000 (initial allocation of \$300,000 and additional \$100,000) and other Scion funds of \$150,000. Total \$550,000.
- Te Uru Rākau (within MPI), via the One Billion Trees Programme, \$450,000, and
- Northland Inc via the Northland Regional Council's Project Development Fund, \$100,000.

The final income and expenditure for the entire project is given in Table 4 and shows revenue by mechanism and/or organisation, and expenditure by work stream and quarter.

The timber revenue collected from the sale of the project timber was not included in this budget and the Steering Group decided to allocate this to funding the next phase tasks. To date only a small portion (<10%) of the timber was sold, in part due to the restrictions from the Covid-19 pandemic.

Operationally, Scion's financial systems were used and adapted (to provide for a multi-year project financial management) which was an asset as a project accountant was assigned to assist the financial reporting of the project according to the requirements of the Steering Group. The approval processes of Scion (3 levels of approval) were also followed in addition to Steering Group oversight to ensure full and transparent accountability with all the appropriate checks and balances.

Table 4. Financial report for TIP project life

As at Project Completion	Project Life-to-Date			Actuals										Project Life Total Actuals	
	Actuals	Org Budget	Variance	FY 2017/18	FY 2018/19				FY 2019/20				FY 2020/21		
				Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1		
Receipts															
One Billion Trees	450,000	450,000	-	-	-	100,000	200,000	100,000	10,000	-	10,000	23,700	6,300	450,000	
Scion Other	150,000	150,000	-	30,000	20,000	40,000	40,000	20,000	-	-	-	-	-	150,000	
Scion PreSeed	400,000	300,000	100,000	60,000	40,000	80,000	80,000	140,000	-	-	-	-	-	400,000	
Northland Inc.	100,000	100,000	-	50,000	-	-	-	50,000	-	-	-	-	-	100,000	
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Receipts	1,100,000	1,000,000	100,000	140,000	60,000	220,000	320,000	310,000	10,000	-	10,000	23,700	6,300	1,100,000	
Expenses															
Forest	366,313	417,233	(50,920)	53,591	52,225	13,591	74,434	135,972	22,842	8,949	1,749	2,961	-	366,313	
Sawing	160,794	170,088	(9,294)	38,192	40,873	12,198	1,297	64,982	3,252	-	-	-	-	160,794	
Drying	110,836	98,400	12,436	22,425	9,676	29,992	17,108	19,767	11,181	686	-	-	-	110,836	
Market	53,981	59,500	(5,519)	-	148	979	5,182	21,782	16,316	5,818	1,127	2,629	-	53,981	
Licence To Operate	46,372	54,500	(8,128)	-	-	905	7,333	13,113	1,282	1,286	6,617	15,835	-	46,372	
Project Management & Admin	186,302	167,200	19,102	34,092	21,499	34,020	20,274	24,390	11,337	10,637	16,412	7,782	5,858	186,302	
Business Model & Analysis	91,016	-	91,016	-	148	247	2,284	4,335	36,300	32,260	14,533	909	-	91,016	
Project Communications	84,387	-	84,387	-	6,569	5,119	9,050	34,207	15,400	5,586	7,923	89	442	84,387	
Total Expenses	1,100,000	966,921	133,079	148,300	131,139	97,051	136,961	318,550	117,910	65,222	48,361	30,207	6,300	1,100,000	
Running Cash Balance	0	33,079	(33,079)	(8,300)	(79,438)	43,511	226,550	218,000	110,090	44,868	6,507	(0)	0	0	
Commentary (updated 20.08.2020)														Contingency	
1. Budget shown is original budget and so final project life to date is predicted revenue and expenses, so these columns are different with extra revenue and some over/under for each work stream															
2. The Budget for the last 3 tasks is held in the PM & Admin line. These last 3 tasks have been split out to provide greater visibility of PM/Admin and these two key tasks, Business Model and Project communications.															
3. Revenue entered on a cash basis (as of the quarter the funding was received by TIP project)															
4. Interest was not charged to TIP when the running cash balance was negative. This is as funds received and paid have occurred via Scion bank accounts providing a funding buffer while waiting payment of 1BTP funding.															
5. Scion accepted a fixed revenue to deliver this project with project & contract management roles, taking on the risk that if over-spent Scion would absorb any minor overrun (in-kind contribution)															

Communications

A formal Communications Management Plan was included as part of the project management documentation at the start of the project. The plan was written by a mix of TIP Steering Group and Operational Team members, as well as support from Scion's Marketing and Communications and Māori Advisory teams. Identifying one person to lead project communications was difficult as engagement with diverse stakeholders including media was required and proved to be a more labour-intensive role that had been anticipated. Therefore, an expert in communications and media management, Due North based in Kerikeri, was contracted to organise the first public event (church floor dedication). From this very positive experience and the resulting media interest and enquires, we continued the engagement with Due North for the rest of the project.

One learning regarding process after the Communications Management Plan was written was the requirement for a clear and simple process for producing and approving regular project updates for our stakeholders. This was eventually formulated to include the Steering Group chair, one other SG member and the project manager. With all the members of the Operational Team and Steering Group involved, the writing and editing process became very protracted and resulted in very delayed project updates. Once Peter Heath from Due North became the contracted Communications manager, this process improved markedly. However, this role had not been previously allocated project funds and so budgets from other work streams needed to be adjusted accordingly. The risk management processes at the operational and governance levels identified significant risk in negative perceptions around the activity and goals of the project, and having this key communications role sufficiently resourced was considered essential for a project of such wide public interest.

A TIP project website (<https://www.totaraindustry.co.nz/>), along with an introductory video was developed with Due North as part of the need to provide one source for information and updates on the project as it progressed. This was launched in August 2019 after extensive text editing by the TIP Operational Team. Social media platforms were set up during this time also.

Over time, the Social Licence to Operate team developed a survey that was put on to the project website to gather views on the project goals and outcomes.

The project website and the associated explanatory video have been very effective tools in providing key information and promoting the activities, goals and desired outcomes for this project. Widespread interest and scrutiny of the project, how it has operated, and its deliverables has been a feature from the start of the project. This project has been the topic of two sets of parliamentary questions (along with other PGF projects), organisational financial audits, government ministers' involvement and requests for updates, media requests for interviews and stories – with potential for adverse public reaction. It might not be usual practice to engage public relations services for such a small project (financially speaking), but in this case these were funds well spent and assisted the project in being proactive with information, promotion, education and well-managed responses to enquires.

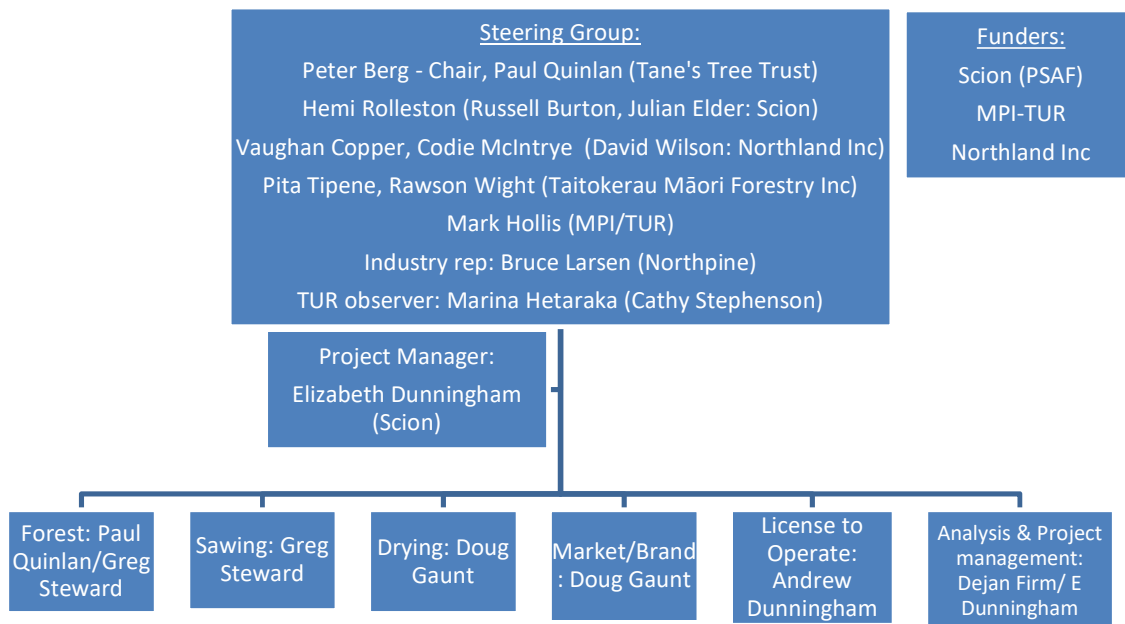
The website also has an enquiry facility which forwards general requests to the project manager (or other delegated person). This tool enables project members to respond directly to those who are wanting further information or to become involved in the project in the future, or enquiries about the timber.

Due North (Peter Heath) has also played a key role in developing and implementing a stakeholder engagement programme to inform and educate Northland opinion-shapers and community leaders whose support for the TIP Project will be important as the initiative moves towards commercial implementation.

Key deliverables (Due North):

- Media engagement and management around the church floor dedication in Matauri Bay (Jan 2019).
- Facilitation of reporters' enquires and interviews (from Jan 2019 to Feb 2020).
- Project Video (produced during May-June 2019).
- Project website (launched August 2019), and continued development of project updates and content for website (to February 2020).
- Establishment of social media platforms & initial engagement on these platforms (set up June 2019 and links included on website) and strategy for proactive engagement.
- Monitoring social and main stream media.
- Monitoring of related media articles (& posting on website if relevant).
- Media training of two TIP members.
- Consultancy around staged communication and perception research (SLO survey).
- Development of Stakeholder engagement programme and engagement with community stakeholders (March to June 2020).

During the project, three technical articles were published using TIP results, two National TV news stories were aired, one radio interview conducted, three press releases given, five media print/online stories were produced from interviews of TIP members, and five project updates were posted on website (with another two publicly available updates). These are listed in Appendix 5 and most can be found posted on the website.



Project structures

The project structure is given in the diagram above, with the Steering Group with current (and past) composition which has governance and strategic direction roles, funders and operational roles.

However, there was an additional role identified of Program manager that would sit between the operational and governance group. Until his departure in August 2018, Russell Burton unofficially filled this role. Since August 2018, some of this role has been covered by the project manager, some by the SG chair and some left uncovered.

Planning & Reporting

The project plans and other documentation were formally signed off by the TIP Steering Group (SG). The Steering Group received technical summaries throughout the project and received the full technical reports as additional reading material. There were Status Update reports at each TIP SG meeting that covered all the operational areas of activity and were structured based on our strategic goals (part of our kaupapa) so the SG were aware of progress towards our long-term goals. The TIP Steering Group meetings were held every 3 months to oversee the work. Contracting for the central government funding was transferred to 1BTP (Te Uru Rākau/MPI) from PGF (MBIE) in August 2018 and was formally contracted after a period of discussion in November 2018. The project formally started on 19 April 2018, ahead of the central government funding, with their agreement.

The project management framework of PRINCE2® was used to plan, monitor, report and deliver the project.

Kaupapa in practice

A range of questions were given to the Steering Group in a survey to cover aspects of how having the Kaupapa worked out in practice. These were:

1. The extent that it influenced decision-making (governance and operational), remembering long-term outcomes & keeping us on task;
2. The extent that having the kaupapa in place early in the project contributed to stronger sense of belonging and unity, focusing the discussions and building relationships within the group;
3. The importance of holding regular sessions during governance meetings to revisit what aspects of our strategic intent might mean in practice;
4. The extent that Te Ao Māori, tikanga and other cultural practices & knowledge considered and followed; and
5. The likelihood that you would recommend having a strategic intent and kaupapa for future projects.

A majority of SG members responded to the survey (6/10) and they were able to provide comments anonymously. The ratings to the first question were very positive (average for all aspects 3.95/5.0, with 1 the least positive and 5 the most positive) with the ratings for the second question also positive (3.66/5.0). Regular sessions during SG meetings when the meaning of aspects of the strategic intent was unpacked were important to all.

There was a range of responses to the question regarding the extent to which Te Ao Māori, tikanga and other cultural practices and knowledge considered and followed, from fair to above average, with other comments that these were considered appropriately and well-embedded. However, it was clear from the Māori engagements later in the project that aspects of the kaupapa and imbedding tikanga in the governance and operational practices can be further developed and applied. This will be ensured with Māori leadership of the next phase.

Overall, all the respondents were highly likely to recommend having an agreed strategic intent and kaupapa for future projects (assuming that there were knowledgeable people either within the group or supporting the group to resource this).

Other key learnings from the operations of this project are given in the following section.

Key learnings and critical success factors

Key learnings on how the project was conducted:

- Strengths of the TIP project were:
 - Having senior and experienced people on the governance group, and skilled and highly engaged operational team members
 - A clear strategic intent from Te Ao Māori including vision, kaupapa, values and long-term goals at the start that were strongly adhered to, with reminders given and expanded discussions at Steering Groups meetings throughout the project.
 - Strong foundation of background research projects, community of interest, regional contacts and personal relationships to support the operational delivery
- Things for improvement were:
 - Revising the budget prior to proposal being submitted for final time with a formal budgeting tool (the proposal had been pending for 3 years prior to final submission and the pre-pilot study had been conducted in the meantime, giving valuable information that was not able to be used). However, we were directed not to revise any details of the proposal except the timing of the milestones.
 - Funds did not allow for the appointment of a program manager or later a commercial manager to drive the planning for the next stage which made the decision-making processes more difficult and protracted.

Critical success factors:

- A committed group active in conducting small projects together already in place (prior Northland tōtara initiative and Northland Tōtara Working Group).
- Project partners highly engaged and committed to project and long-term initiative.
- Formalisation of governance and operational structures, including the requirement of a qualified project manager at the start of the project.
- A detailed and well-thought out project proposal.
- A strong commitment to the objectives of the project and to deliver within time and budget by all involved.

Appendices

Appendix 1: Deliverables summary






The milestone table from the agreed project plan (in PID) has been provided here, with a comment on what has been delivered.

Work stream	Task	Deliverable(s)	Comment	Delivery & results
1 Forest	1.1. Characterisation of the resource	Northland resource assessment (report)	Review point	Preliminary resource assessment only. Estimated that tōtara-dominant area was about 26,300 ha compared to the estimated area of 200,000 ha used in proposal calculations (of bush containing tōtara). LiDAR data sets required for more accurate assessment.
	1.2. Harvest, Log production & assessment	Detailed harvest reports (100 m ³ , 400 m ³)		Two detailed harvest reports from Stage 1 (100 m ³) & Stage 2 (200 m ³ , reduced volume). These demonstrated low-impact best-practice continuous cover forest harvesting can be done with farm-tōtara resource.
2 Sawing	2.1 Establishment of grade recoveries and timber characteristics	Sawing reports (100 m ³ , 400m ³), possibly joint with harvest reports	Review point, key piece of IP	These were produced jointly with the harvest reports. First milling was done at a training mill, second a trial at commercial scale radiata pine mill, with very good log to lumber yields (56%).
3 Drying	3.1 Drying studies to determine if it can be accelerated	Drying report, "DrySpec" for tōtara, Dried timber	Drying schedule, key IP	Development of kiln-drying schedules for green timber of 25 mm and 50 mm boards. Commercial scale (47 m ³) kiln drying trial of 25 mm boards successful. Topping-off of partially air-dried 50 mm boards in smaller kiln successful (20 m ³). More than 147 m ³ timber produced and available to sell to seed market.
4 Market Development	4.1 Seeding the market	Decision point of application focus & price point	Review point	An initial donation of 8 m ³ timber (from pre-pilot study) to JSC gave preliminary feedback that there was interest. JSC was contracted to sell timber for interior applications and provide feedback, paying TIP a discounted price. Price points are

				higher than what had been predicted and grades less important.
	4.2 Development of promotional material	Promotional and Brand material, report from engaged company (Brand ID)		Website and video have been produced for promotion of objectives and results to date. Decision was taken not to start a Brand exercise, so this was not done (due to budget constraints and suitability / timing).
5 Licence to Operate	5.1 Engagement with Stakeholders	Workshops leading to limited or no negative feedback from SH group on the development of industrial use of tōtara		Initial engagement with selected stakeholders was primarily done with one-to-one interviews. Group workshops did not occur, but a public survey was included in the website (with little response to date). However, there was little adverse direct reaction to project operations from wider community. Further stakeholder engagement was conducted after key results were obtained and is on-going.
6 Project Analysis	6.1 Development of a business model	Recommended Business model	Depends on review points	<p>The operational financial model (PwC) was revised to include data from project operations and showed that there was a viable business opportunity, even using lower volumes of timber.</p> <p>Business advice was contracted to Spring and they identified two value-added product options, for which they outlined business cases in more detail and proposed resource-led business models and road maps with which to implement these opportunities.</p>
	6.2 Project Management	Timely reporting and delivery		Reporting to SG and funding agencies (TUR/PSAF/Scion /TTEAP) done on quarterly basis (or as required). Operational team meetings operated as required, with timing changed as need, as agreed by group. Extra funds (\$100k) were secured from PSAF.

Appendix 2: Tree form criteria

Tree form was subjectively assessed using tree shape (i.e. stem straightness and length, and proportional lower branch size) relative to log quality. A set of descriptors was developed for each class by Kennedy (2007)⁵, but has been refined since then. Examples from the 100 m³ harvest are below.

Class 1	Class 2	Class 3	Class 4	Class 5
Excellent	Good	Fair	Poor	Non-merchantable
Single straight trunk, clear bole or only a few small branches, no other apparent defects.	Single straight trunk, some small-medium branches, may fork or have heavy branches above lower log.	Short or multiple logs, down-graded by defects such as moderate-heavy branching, slight sweep, twist or wobble.	Short butt log lengths only, may have confused grain and some knots.	No apparent merchantable volume.
Log length = 6.0+ m.	Log length = 4.0 - 6.0+ m.	Log length = 2.7 - 4.0+ m.	Log length = 1.5 - 2.7 m.	Log length = <2.0 m
				

⁵ Kennedy, C. 2007; Developing Methodology for Resource Assessment of Naturally Regenerating Totara in the Whangaroa Community Area, Northland. Tane's Tree Trust.

Appendix 3: Grade recovery data from pre-pilot, first and second project harvests

Details of graded sawn tōtara timber by linear metres and volume. Grades ranked (left to right) highest to lowest value (mixed relates to boards containing heartwood and sapwood).

	Dimension (mm)	Clears		No 1 Cuttings		Dressing		No 2 Cuttings		Building		Box	Total
		Heart	Mixed	Heart	Mixed	Heart	Mixed	Heart	Mixed	Heart	Mixed		
Linear (m)	75×25	-	195.9	-	104.7	-	44.4	-	30.3	-	-	28.2	403.5
	100×25	26.7	334.3	-	128.1	5.7	144.6	-	7.8	-	-	43.2	690.4
	150×25	5.7	198.0	5.7	71.8	22.5	257.9	-	20.1	-	-	57.0	638.7
	150×50	17.4	17.4	-	-	162.6	22.2	-	-	126.2	3.3	3.9	353.4
	200×25	67.2	173.1	5.4	69.0	46.2	164.4	15	6.0	-	-	46.5	593.1
	200×50	24.3	-	-	-	285.9	54.6	-	-	65.4	15.0	36.9	482.1
	Total	141.3	918.7	11.1	373.6	522.9	688.1	15	64.2	191.6	18.3	215.7	3161.2
Volume (m ³)	75×25	-	0.367	-	0.196	-	0.083	-	0.057	-	-	0.053	0.757
	100×25	0.067	0.836	-	0.320	0.014	0.362	-	0.02	-	-	0.108	1.726
	150×25	0.021	0.743	0.021	0.269	0.084	0.967	-	0.075	-	-	0.214	2.394
	150×50	0.131	0.131	-	-	1.220	0.167	-	-	0.95	0.025	0.029	2.651
	200×25	0.336	0.866	0.027	0.345	0.231	0.822	0.100	0.03	-	-	0.233	2.967
	200×50	0.243	-	-	-	2.859	0.546	-	-	0.654	0.150	0.369	4.821
	Total	0.798	2.943	0.048	1.13	4.408	2.947	0.1	0.182	1.604	0.175	1.006	15.316

Dressed linear metres recovered by grade and dimension from the first project harvest (100m³)

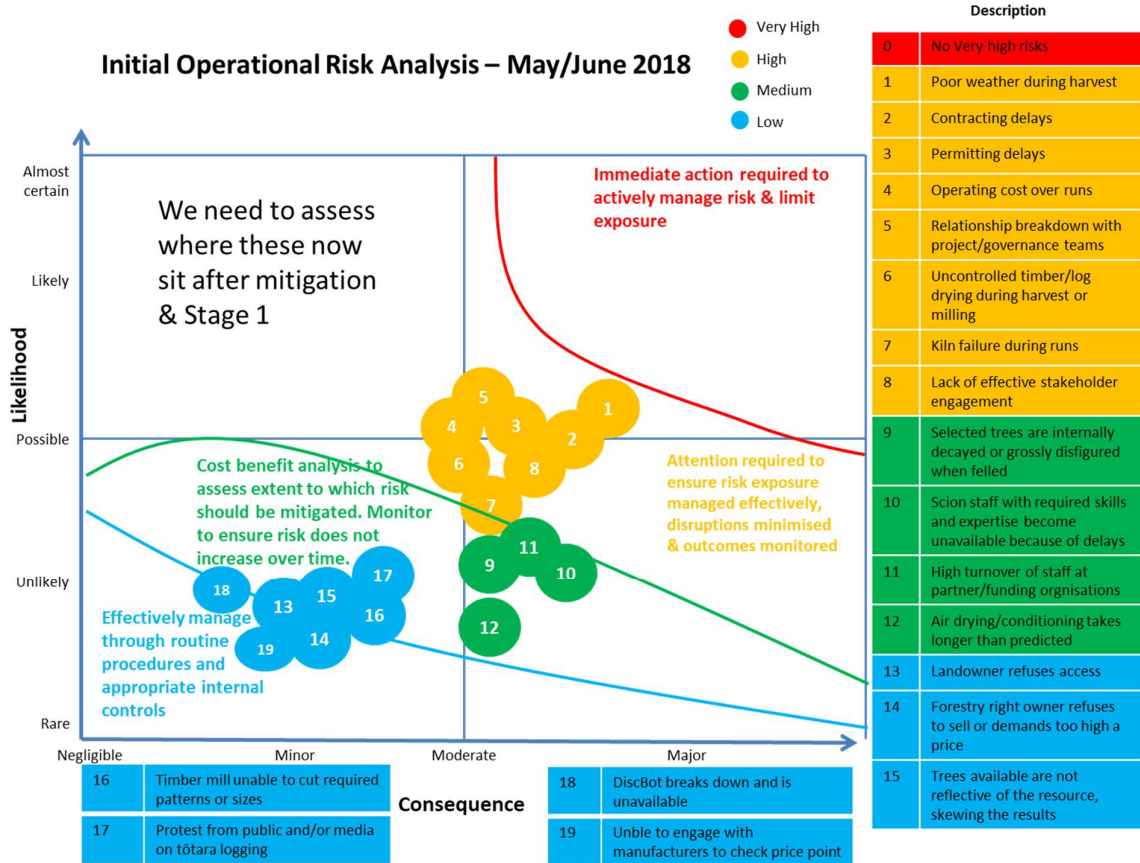
Grade	Dimension (mm)						Total
	75×25	100×25	150×25	150×50	200×25	200×50	
heart clear	8.2	29.6	20.9	28.5	12.0	11.7	110.9
heart dressing	4.5	25.7	154.7	499.0	70.8	384.2	1138.9
heart mixed	5.6	43.0	46.7	33.7	41.6	15.4	186.0
heart box	4.0	11.4	45.2	283.3	25.7	169.7	539.3
sap clear	211.2	230.7	163.3	25.2	78.3	8.3	717.0
sap dressing	200.0	344.8	452.3	499.2	328.3	268.8	2093.4
sap mixed	212.8	431.6	344.1	33.5	138.7	10.4	1171.1
sap box	77.5	129.9	148.3	193.8	129.0	235.0	913.5
Total	723.8	1246.7	1375.5	1596.2	824.4	1103.5	6870.1

Dressed linear metres recovered by grade and dimension from the second project harvest (200 m3)

Grade	Dimension (mm)									Total	%
	50x25	75x25	100x25	100x50	150x25	150x50	150x100	200x25	200x50		
Dress	356.4	172.8	1620.0	180.0	5671.5	1574.7	-	1986.9	507.3	12069.6	53.3
No.1 clears	-	250.8	966.0	-	1322.1	372.0	60.0	436.8	-	3407.7	15.1
Mixed	-	277.2	756.0	145.2	2008.8	210.6	-	1242.0	231.0	4870.8	21.5
Slab	-	-	-	-	-	-	-	-	42.0	42.0	0.2
Box	-	-	150.0	-	989.7	470.4	180.0	306.0	144.00	2240.1	9.9
Total	356.4	700.8	3492.0	325.2	9992.1	2627.7	240.0	3971.7	924.3	22630.2	100

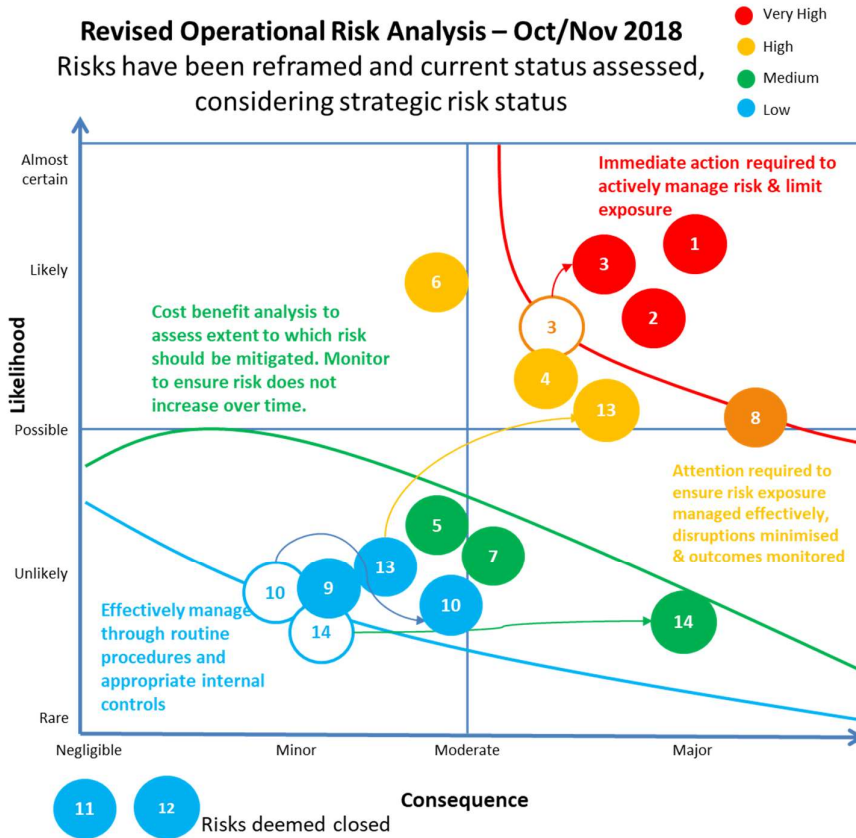
Note the extra dimensions produced.

Appendix 4: Technical risk heat maps at start (June 2018) after revision (Nov 2018) and after Stage 2 operations (Sept 2019)



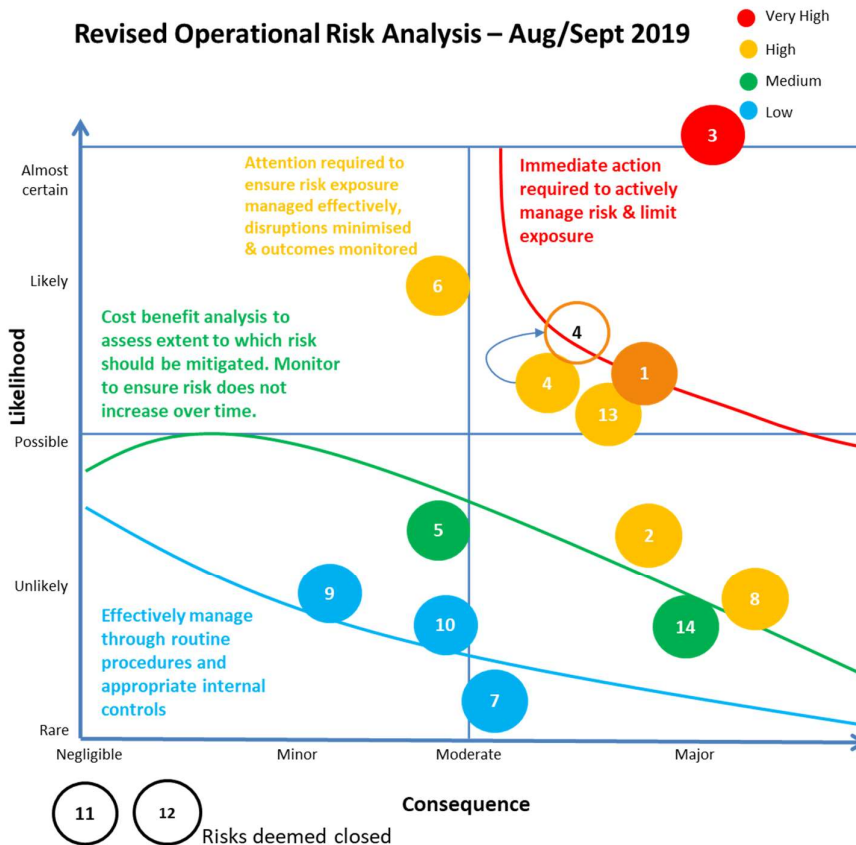
Revised Operational Risk Analysis – Oct/Nov 2018

Risks have been reframed and current status assessed, considering strategic risk status



Description	
1	Contracting (engage right people)
2	Milling and Kiln facilities engaged
3	Permitting
4	Operating cost over runs
5	Uncontrolled timber/log drying during harvest or milling
6	Lack of effective stakeholder engagement
7	Tree selection give poor grade recovery/log quality
8	Project staff with required skills and expertise become unavailable
9	Trees available are not reflective of the resource, skewing the results
10	Landowner dissatisfaction
11	Timber mill unable to cut required patterns or sizes
12	Unable to engage with manufacturers to check price point
13	Protest from public and/or media on tōtara logging
14	Resource not available

Revised Operational Risk Analysis – Aug/Sept 2019



Description	
1	Contracting (engage right people)
2	Milling and Kiln drying done
3	Permitting
4	Operating cost over runs
5	Uncontrolled timber/log drying during harvest or milling
6	Lack of effective stakeholder engagement
7	Tree selection give poor grade recovery/log quality
8	Project staff with required skills and expertise become unavailable
9	Trees available are not reflective of the resource, skewing the results
10	Landowner dissatisfaction
11	Timber mill unable to cut required patterns or sizes
12	Unable to engage with manufacturers to check price point
13	Protest from public and/or media on tōtara logging
14	Resource not available

Appendix 5: List of publications and media coverage on the TIP project

Technical articles:

- Greg Steward and Paul Quinlan “Totara industry pilot project: A fresh look at a familiar Northland species”. NZ Tree Growers, November 2019
- Steward, GA (2019) “To the heart of the matter - heartwood content in tōtara.” New Zealand Journal of Forestry, 64 (2) August 2019
- Steward, GA, & McKinley, RB (2019) “Indigenous plantations - implications for wood quality.” New Zealand Journal of Forestry, 64 (2) August 2019

Our thanks to the [New Zealand Journal of Forestry](#) for making these publications available on our website.

Broadcast media:

- NewsHub 27 January 2019 on church floor story in Matauri Bay
- ONE News 8 July 2020 about the project overview and delivery of pilot work: : <https://www.tvnz.co.nz/one-news/new-zealand/team-behind-totara-timber-trial-confident-native-wood-can-harvested-large-scale>
- Te Hiku FM – interview with Pita Tipene (June 2020)

Print articles and public updates:

- **Hanock, Farah** “ Tōtara project sets sights on sustainable timber”, Newsroom, 21 August 2018, <https://www.newsroom.co.nz/2018/08/20/199880/the-revival-of-the-ttara-industry>, accessed 15 June 2020
- **Hayley Leibowitz**, “Continuous cover forestry: A vision for tōtara”, NZ Logger, May 2020, pp18-30 <https://issuu.com/nzlogger/docs/lgmay20?fr=sMzliZjExMDE5Ng>
- **Heath, P.** “Politics, science and a love story”, Northland Age (Kaitiāia), 14 March 2019, p14
- **Laird, L.** “2 love stories”, Northland Advocate (Whangarei), 16 February 2019, pp2-3
- NZME, “Website set up to air viability of tōtara”, Northland Advocate (Whangarei), 22 August 2019, p1 The Country section
- **Quinlan, P.** “Totara Industry Pilot project”, Tane’s Tree Trust (News and events section), 18 October 2018, <https://www.tanestrees.org.nz/news-events/articles/totara-industry-pilot-project/>
- **Quinlan, P.** “Northland Tōtara Working Group Newsletter 2019”, Tane’s Tree Trust (NTWG webpage), August 2019, https://www.tanestrees.org.nz/site/assets/files/1234/ntwg_newsletter_aug_2019_1.pdf
- **Smith M.** “Totara Industry Pilot: the business case for an indigenous NZ species” Timber and Forestry E News (Australia), 8 November 2018, Issue 536, pp18-19
- Tōtara Industry Pilot News, February 2019, project newsletter

Other media coverage is posted on the project website related to the TIP project that resulted indirectly and not as interviews of TIP members.