



Prosperity from trees

Statement of  
Corporate Intent  
2014-2019









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2014-2019

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# Profile

**New Zealand Forest  
Research Institute  
Limited** Trading as Scion

**Head Office** 49 Sala Street, Rotorua

**Postal Address** Private Bag 3020, Rotorua 3046

**Web address** www.scionresearch.com

**Ownership** Crown owned entity (established under the Crown Research Institutes Act 1992)

**Governance** Shareholder-appointed Board: Chair, Tony Nowell (2010); Deputy Chair, Judith Stanway (2010); Directors, Sheldon Drummond, Chris Insley (2008), Brian Rhoades (2009), Elizabeth Chambers (2012), Barry O'Neil (2012).

**Executive Management** Chief Executive, Warren Parker; General Manager Research and Investments, Russell Burton; General Manager Manufacturing and Bioproducts, Elspeth MacRae; General Manager Forest Science, Brian Richardson; General Manager Business Development and Commercialisation, Steve Sopora; General Manager People and Performance, Keri-Anne Tane; Chief Financial Officer and Company Secretary, Rob Trass.

**Staff** 296 full-time-equivalent staff at five sites: Rotorua (269), Christchurch (24), Auckland (1), Wellington (1), Dunedin (1).

**Shareholder Funds** Total book value of \$30.796 million at 30 June 2014.

**Vision** Prosperity from trees - *Mai i te ngahere oranga*

**Core Purpose** To drive innovation and growth from New Zealand's forestry, wood product and wood-derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

**Values** Vital, Innovative and Collaborative.

**Reporting** Financial and non-financial performance against SCI targets is reported to the Shareholder quarterly and to the public via a six month and annual report.

## Shareholdings

COMPANY	COMPANY TYPE	SCION SHAREHOLDING %
Te Papa Tipu Properties Ltd	A land holding subsidiary	100.00
Biopolymer Network Ltd	An incorporated joint venture	33.30
WQI Ltd (Solid Wood Innovation)	An MBIE-industry partnership in wood processing	5.95
Terax (2013) Ltd	The General Partner in Terax Limited Partnership	50.00

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# Chairman and Chief Executive overview

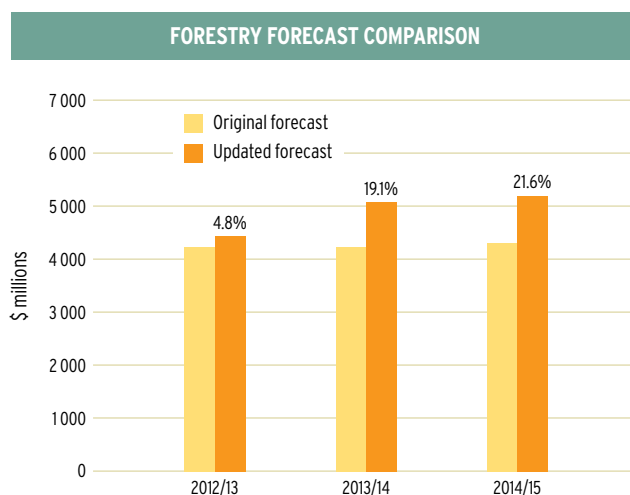
We are pleased to present Scion's 2014-19 Statement of Corporate Intent (SCI) and set out Scion's strategy, science and innovation plan, and investment priorities. In our SCI we also describe how Scion will work with the forest industry, Māori, government and communities to fulfil our Statement of Core Purpose. We outline how Scion's strategy has been 'refreshed' to reflect changes in our operating environment such as the National Science Challenges and rising dominance of China on demand for New Zealand forest products and iwi's growing influence on forestry. Also important is how Scion's work will support the Government's business growth agenda goal to grow exports to 40% of GDP by 2025 and assist regional economic development.

Scion, now the largest provider of manufacturing research and development among the Crown Research Institutes, has a particularly important role in boosting the performance of firms that process and use biomaterials derived from forests, waste streams and other sources.

The forest industry incorporates forest production, solid wood and fibre processing; and the emerging renewable composite materials, energy and biochemical sectors. It is New Zealand's third largest exporter and contributes strongly to the domestic economy through the construction and housing sector, regional employment, and the provision of environmental services such as flood and erosion mitigation. Collectively the forest industry's value chain generates about \$12 billion of sales annually. Forestry also produces environmental services worth an estimated further \$600-800 million per annum.

The goal of Woodco's "New Zealand forest and wood products industry strategic action plan" is to grow exports from a baseline of \$4.5 billion in 2011 to \$12 billion by 2022. The industry's confidence in achieving this target is underpinned by:

- Strong market demand (driven by population and wealth growth in economies relatively close to New Zealand, e.g., the ASEAN group, China) and a forecasted global shortfall in softwood supply.
- A growing annual harvest of logs, peaking at some 33-36 million m<sup>3</sup> by the early 2020s.
- The 2012 WoodScape analysis of technology options showing there are achievable pathways to lift the profitability of wood and wood fibre processors.
- Major global shifts toward renewable energy and renewable, lightweight industrial products technologies (i.e., bio-based economies).
- The superiority of wood buildings in high hazard environments and trend towards prefabricated 'complete solution' building systems.
- Growing natural resource constraints such as new



	2012/13	2013/14	2014/15
Original forecast	\$4 272	\$4 291	\$4 347
Updated forecast	\$4 478	\$5 111	\$5 284
Percentage change	4.8%	19.1%	21.6%

Source: MPI SOPI<sup>1</sup> Update (2014)

<sup>1</sup> Situation and outlook for the primary industries

environmental limits for water availability and quality, and climate change impacts (e.g., increased frequency of extreme weather).

While the January 2014 export data indicate the forest industry is doing well compared to plan (see insert), the most critical component of achieving Woodco's '\$12 billion' goal is to lift the proportion of logs processed onshore from the current 45-50% to 70%. This requires a combination of efficiency gains in mills (especially those producing solid wood products), modernisation of building standards to incorporate engineered wood products, increased returns from sawmill residues and lower quality (A & K grade) logs, and much improved information flows and integration across the forest industry value chain. There are other challenges to meet too: the safety of forestry workers needs to be assured, deforestation arrested, log supply security improved, market access and trade terms for wood improved for wood products, the dependence on China reduced, and industry investment in innovation (particularly in wood processing) needs to more than double if the transformational elements of its Woodco strategy are to be achieved. In addition, further rationalisation of old mills will be necessary to improve scale, productivity and specialisation.

Scion is working very closely with industry and policy makers to implement a science and innovation (S&I) plan

that will deliver solutions for nearly all of these challenges. Our jointly developed S&I plan has six Intermediate Outcomes (IOs):

1. Maximise the value and profitability of commercial forests and their ecosystem services.
2. Increase the profitability of solid wood processing through customer solutions and supply chain innovations.
3. Expand opportunities in the wood fibre, pulp, biopolymer, packaging and biochemical industries.
4. Increase New Zealand's energy security through the use of forest biomass, clean technologies and industrial symbiosis.
5. Protect and enhance market access and improve risk management in the forest industry including for forest health and preparedness for biosecurity incursions, fire and climate change.
6. Ensure the forest industry's licence to operate (and reputation) through worker safety and capabilities, verifiable environmental performance, product traceability and modern standards; and, by anticipating long-term change.

Scion's business model is fully aligned to achieving these outcomes. This includes sustaining partnerships with industry, collaboration with research providers nationally and internationally, investing in specialist equipment and pilot plant infrastructure to assist technology scale-up, and developing talent and other capabilities to support earlier and faster transfer of new knowledge and technology to users. Core Funding (\$17.7 million) is invested to support achievement of impact measures through (and across) each of the IOs. About 55% of this will be for applied research.

In addition, Scion proposes to reinvest \$1.03 million of its surpluses in 2014/15 (and about \$1.1 million per year

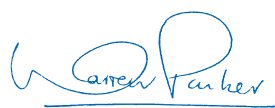
thereafter) to accelerate technology transfer and commercialisation; improve industry connections through staff secondments into firms (and vice versa); support the development of the Māori economy through the forest industry; and exploit the potential of 'big data' tools to access and re-use data from Scion and many other parties. This work complements our 10-year capital asset plan to develop a highly attractive work environment through the modernisation of buildings, laboratories and equipment; and installing pilot plants to support the scale-up and de-risking of our most promising technologies. We are now into year four of our strategy and it is progressing to plan.

The wider economic context in which Scion's SCI is set is generally improving; however market volatility and the risk of a 'global shock' remains relatively high in historic terms. Accordingly, prudent top line growth, cost control and balance sheet flexibility are embedded in Scion's financial projections to June 2019. Revenues are budgeted to increase in 2014/15 by 2.5% to \$49.034 million, and earnings before interest and tax and after reinvestment to reach \$2.399 million. This generates a return on equity before reinvestment of 7.8% and a tailored rate of return of 5.6%.

Achievement of these returns is predicated on revenue gained through the National Science Challenges, success with commercialisation initiatives (e.g. royalties from Woodforce sales growth), Government agency contracts (particularly with MPI and MfE) being sustained, Primary Growth Partnerships being either secured (e.g., in the wood products/building systems area) or extended ('Stump to Pump'), and partnership programmes with Māori being funded. Notwithstanding these uncertainties, with the commitment of our staff and on-going industry support, we expect Scion to sustain its financial performance and capacity to invest in initiatives to assist the forest industry to achieve \$12 billion of exports by 2022.



Tony Nowell  
Chair



Warren Parker  
Chief Executive

# 1. Scion

The New Zealand Forest Research Institute (trading as Scion) was established as a Crown Research Institute (CRI) in 1992. It is wholly owned by the New Zealand Government and constituted as a limited liability company under the New Zealand Companies Act 1993. Scion is New Zealand's leading provider of science and technology to New Zealand forest-based companies.

In October 2010, Scion's Statement of Core Purpose (SCP) was adopted. This is to "drive innovation and growth from New Zealand's forestry, wood product and wood-derived materials and other biomaterial sectors, to create economic value and beneficial environmental and social outcomes for New Zealand"<sup>1</sup>. Scion is responsible, in partnership with industry, Government and Māori for achieving four national outcomes:

- Increase the value and productivity of these industry sectors to the New Zealand economy through improved forestry practices and production systems and increased diversification of New Zealand's biological industry base to meet current and future global market needs.
- Protect and enhance market access and improve risk management in the forest industry.
- Increase renewable energy production and energy security by growing New Zealand's ability to produce sustainable bioenergy and liquid biofuel products.
- Enhance New Zealand's opportunity to benefit from forestry-based ecosystem services to improve both the global market position of industry and the environmental sustainability of forestry production in New Zealand.

Scion's development has paralleled the evolution of commercial forestry and its associated industries in New Zealand over the past 100 years. For example, Scion, and its predecessors from the 1920s, developed the genetics of trees whose progeny now populate over 90% of the commercial forest estate. In the late 1950s, research into wood manufacturing and wood products commenced, and this led to the development of many technologies (e.g., drying, preservation, fibre production) that are now widely used by New Zealand's wood manufacturing companies. In 2000, Scion extended its focus to the development of renewable chemicals, materials and energy from forest resources and, later, into ecosystem services (such as payments for carbon storage) to further extend the portfolio of revenue streams available from forests. These changes reflected the rapidly increasing international interest in developing substitutes for petrochemicals and to enhance New Zealand's environmental resilience and energy security.

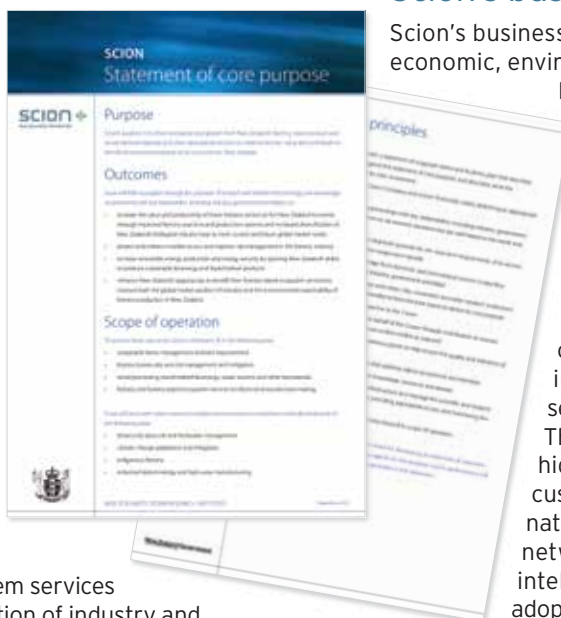
These achievements have built Scion's reputation as a world-leader in forest industry research and development. It has developed a distinct multi-disciplinary capability across the value chain from germplasm generation to the design and application of wood, fibre and other forest resources in commercial products and services. These capabilities have established knowledge and technology platforms that can be applied to other non-forest biomaterials such as in the packaging and waste sectors. Scion also fulfils an important role in providing the evidence base for public policy on forestry and working internationally to formulate, for example, new biosecurity protocols and standards for wood products, packaging and new bio-based materials.

## Scion's business model

Scion's business model is designed to create economic, environmental and social value for New Zealand. This is achieved by working closely with our stakeholders to identify their needs and where their largest opportunities lie, developing new knowledge and technology to meet these needs, and ensuring that the outputs from Scion's work are readily and optimally inserted into the forest industry and wider biomaterial sector value chains (see Figure 1). The foundations of this model are high quality partnerships with customers and Māori; an extensive national and international research network to access new ideas, intellectual property (IP) for direct adoption or adaption to New Zealand; internationally competitive science

and support staff; and, modern research laboratories, plant, equipment and ICT systems. Recurring revenue streams, mostly for contract services, are built through the above activities. In the future, a larger proportion of income (aspiration 20%) will be derived from the licensing and sale of technologies Scion has commercialised with partners. A customer-centric culture, strong science translation capability and a value chain perspective imbues this model. Collectively, this business model design generates critical mass, supports efficient technology translation and leverages stakeholder expertise to deliver solutions to problems and value to the New Zealand forest industry.

Scion is actively shaping a Rotorua-based 'Forest Industry Centre of Excellence' in order to attract new investment into the sector and facilitate regional economic growth (see page 20). Our North Drive Innovation Park, industry tenants (27 firms) and the Bay of Plenty tertiary education initiative are central elements of this. To boost the formation of a regional 'hub', an interest free loan has been secured



<sup>1</sup> The full Statement of Core Purpose is available at <http://www.scionresearch.com>



from the Bay of Plenty Regional Infrastructure Fund to enable the construction of a multi-functional 'innovation centre' building. The aim is to have this occupied by the second half of 2015. Companies involved in innovation in the manufacturing, services (e.g., IT, engineering) and learning and development will be preferentially sought as tenants for this new facility.

Scion's other major site is within the School of Forestry at the University of Canterbury, Christchurch. Close contact is being maintained with the University of Canterbury (and the School of Forestry) regarding its rejuvenation plan, and also with the Lincoln 'hub' development, to ensure the forest industry is well placed with regard to these developments.

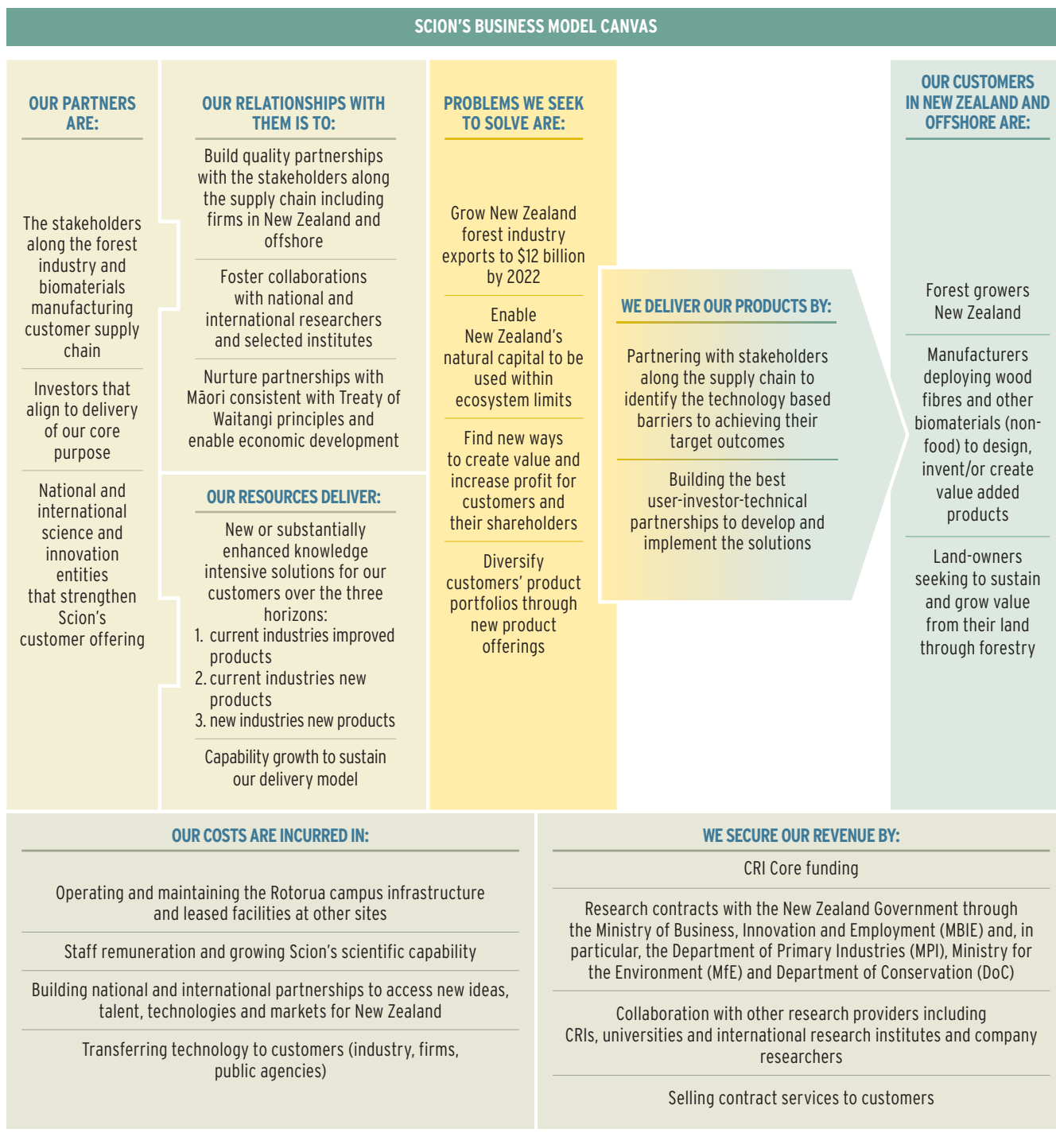


Figure 1: Scion's business model canvas<sup>2</sup>.

This SCI describes how this business model will be applied to support the forest industry to meet its goals and, in so doing, enable Scion to achieve the national outcomes in its Statement of Core Purpose.

<sup>2</sup> After Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*. (pp. 18-19). New Jersey, USA: John Wiley & Sons Inc.

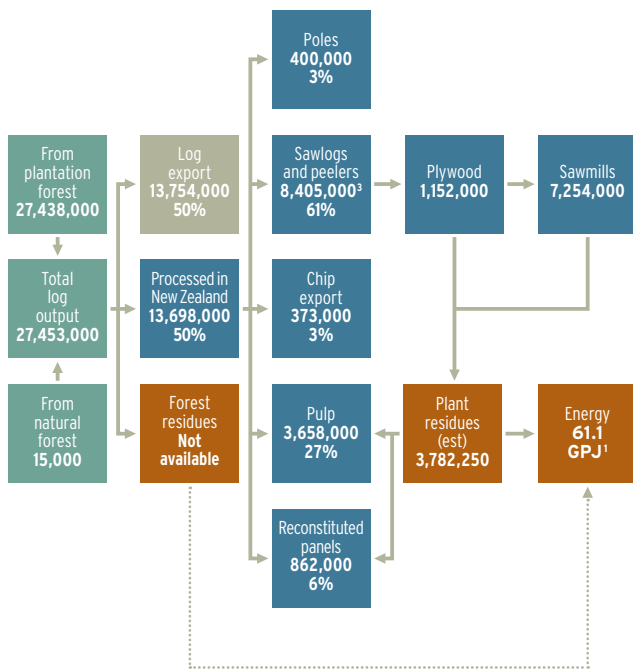
# 2. Growing and transforming the New Zealand forest industry

The New Zealand forest industry's overarching goal is to increase exports of wood based products and logs to \$12 billion (from a \$4.8 billion baseline in 2011). Concurrently, the value of related forest technologies is expected to grow by at least \$2 billion annually by 2022<sup>3</sup>. National energy security will be improved by creating 24 petajoules (PJ) of energy; and climate change effects mitigated in a small way by sequestering 26.7 million tonnes of carbon per annum<sup>4</sup>.

The foundation of the industry is 1.73 million hectares of plantation forests. These generate the log flows illustrated in Figure 2a. Further information describing the characteristics and performance metrics of the forest growing and post-forest 'gate' sectors is presented in Appendices 1 and 2, respectively.

## NEW ZEALAND FOREST INDUSTRY SCALE AND LOG FLOW

Volumes in (m<sup>3</sup>) roundwood equivalent. Year ended 31 December, 2012.\*



GPI: Gross Petrajoules  
<sup>1</sup>Source: NZ Energy Datafile 2012, Woody Biomass  
<sup>\*</sup>Source: MPI and FOA

Figure 2a: Log flow in the New Zealand forest industry<sup>5</sup>.

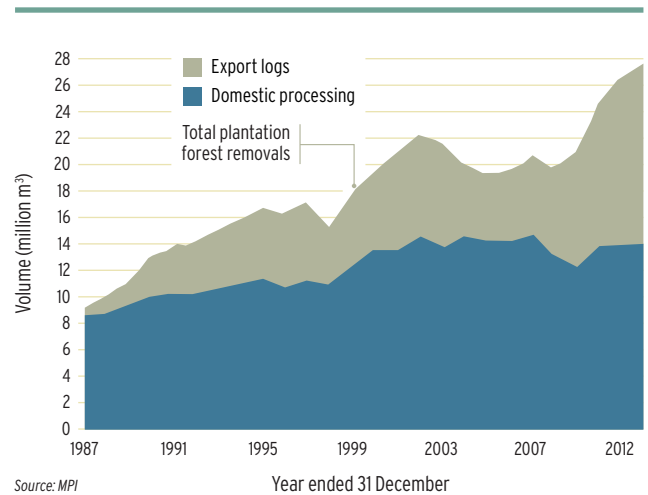


Figure 2b: Processed in New Zealand vs log export<sup>5</sup>.

## New Zealand's commercial forests (see also Appendix I)

New Zealand's 1.73 million hectares of commercial forests have a standing volume of 512 million m<sup>3</sup> of timber as at 1 April 2013. About 90% is radiata pine, 6% is Douglas-fir and the balance consists of cypresses (0.5%), eucalypts (1.4%), other exotic softwoods (1.4%) and exotic hardwoods (0.7%). The majority (91%) of forests are privately owned, with the balance owned by the Crown (3%), local government (3%), state owned enterprises (1%) and public companies (2%). An estimated 45,000 hectares of replanting and 4000 hectares of new planting occurred in 2013.

Trees create value for New Zealand in many ways, both directly and indirectly. During its growth a tree stabilises land, enhances water and air quality, absorbs carbon and provides a back-drop to amenity activities such as recreation and ecotourism. On maturity it can be disassembled to provide materials for construction, interiors and landscaping; fibre for packaging and paper; and a growing array of chemicals and energy products. In conjunction with this supply chain, companies produce furniture and other high

<sup>3</sup> Wood Council of New Zealand Inc. (2012). *New Zealand Forest and Wood Products Industry Strategic Action Plan*. Retrieved 23 April 2014 from <http://www.woodco.org.nz>  
<sup>4</sup> Ministry for the Environment. (2014). *New Zealand's Greenhouse Gas Inventory 1990-2012*. Retrieved 23 April 2014 from <http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2014/greenhouse-gas-inventory-2014-year.pdf>  
<sup>5</sup> Forest Owners Association. (2011/2012). *New Zealand Forest Facts & Figures*. [http://nzfoa.org.nz/images/stories/pdfs/nzf8135\\_factsfigures.pdf](http://nzfoa.org.nz/images/stories/pdfs/nzf8135_factsfigures.pdf)

value manufactured goods, and develop and supply technologies and machinery such as timber drying kilns, harvesting machines, biorefinery plant and process automation equipment. Forests are typically the environment for New Zealand's fast growing ecotourism industry.

Forest growing, processing, design and construction companies within the forestry industry produce about \$6.4 billion of sales per annum<sup>6</sup>. Adding sales from furniture manufacture, carbon, kilns and other parts of the forest value chain at least doubles this value<sup>7</sup> with exports of pulp, paper, wood manufactured products and logs being New Zealand's third largest merchandise export earner<sup>8</sup>. The forest industry generates high value per full-time worker (on average about \$215,000 of GDP/FTE in the Bay of Plenty<sup>9</sup> region) and about 4 to 6 'downstream' jobs per employee. Thus, while the industry comprises many small to medium and a few large firms, it has a powerful influence on regional development and community well-being, especially in smaller urban centres and rural districts of New Zealand.

## An industry in transformation

The forest industry, by the mid 2020s, will be very different from that of today as it responds to and supports a world where assets such as materials (for construction and consumer goods), energy, and water availability are scarcer and much more highly valued than at present<sup>10</sup>.

The cost and the availability of energy and water are already creating international concern as are the effects of climate change, biosecurity outbreaks and security of food supply. With a world population expected to be about 9 billion (currently 7 billion)<sup>11</sup> by 2050, and overall wealth increasing especially in fast growing emerging economies, global food and fibre production will need to dramatically increase off a smaller base of natural resources. An estimated 75% of all new market growth will occur in cities with the largest 100 of these being responsible for 35% of future demand. At the same time, society must adapt to a likely 1-3°C warmer and more hazardous climate and associated changes in pests and diseases<sup>12</sup>. Many 'advanced' economies will be confronting the challenges of an aging population with fewer workers, and in Europe, Russia and Japan, in particular, negative population growth. This mix of factors will dramatically alter New Zealand's future markets and could increase regional political instability and the flow of migrants. Indeed, by 2030 New Zealand will be more ethnically diverse with more Māori (25%), Pasifika and Asian (perhaps 20-25%) populations and concentrated in the upper North Island.

## The New Zealand forest industry encompasses companies that:

- Grow and manage forests for economic, environmental and amenity purposes.
- Convert trees into multiple products including logs, timber for construction, and manufactured products (e.g., pulp, paper, panels and fit out, and furniture) and engineered products (e.g., laminated timber).
- Produce renewable chemicals (e.g., biopolymers and extractives), composite products (e.g., fibre plastic componentry), adhesives and coatings, packaging and energy (e.g., wood pellets, biofuels) from wood and forest resources.
- Manufacture machinery and equipment for forest management (e.g., harvesting) and forest resource processing (e.g., drying kilns, biorefining plants).
- Provide support services that supply systems to protect forests, treat timber, software, engineering and logistics.

These global drivers are underpinning very large public and private sector investment into technology that will enable a transition to a new biobased future during the twenty-first century. In Europe, the Americas and Asia energy, water and food security are much more pressing issues than in New Zealand. Nations within these regions are planning for and transitioning to a new knowledge-based bioeconomy<sup>13</sup> future through the installation of biorefineries, land use change and prioritising 'green economy' research and development investment.

They are also strongly promoting the use of clean technologies (recycling, renewable energy, process efficiencies to reduce waste and eliminate emissions), industrial biotechnology<sup>14</sup> and the judicious use of genetic modification (such as for disease and drought tolerance) to find solutions to food and fibre supply and energy security and at the same time improve environmental protection.

The forest industry can play a significant role in helping New Zealand to meet its targets to grow export revenue, create high wage jobs and improve environmental resilience including reaching New Zealand's international greenhouse emissions reduction targets. It will also contribute to better social outcomes for New Zealanders, build the manufacturing sector and strengthen the Māori economy by adding to their current \$2 billion forest asset base.

<sup>6</sup> Wood Processors Association of New Zealand and New Zealand Pine Manufacturers Association. (nd). *Wood Processing and Manufacturing Science and Innovation Plan*. <http://www.pine.net.nz/resources/LatestNews/WoodProcessingandManufacturingScienceandInnovationPlan.pdf>

<sup>7</sup> Based on data (including forestry, wood processing, paper manufacturing, wood buildings, furniture, kilns and forest machinery) sourced from the 2009 Annual Enterprise Survey, New Zealand Department of Statistics.

<sup>8</sup> Wood Council of New Zealand Inc. (2012). *New Zealand Forest and Wood Products Industry Strategic Action Plan*. Retrieved 23 April 2014 from <http://www.woodco.org.nz>

<sup>9</sup> John Galbraith personal communication, May 2012.

<sup>10</sup> Winston, A. (2014, April). Resilience in a hotter world. *Harvard Business Review* 56-64.

<sup>11</sup> United Nations. (2004). *World Population to 2300*. <http://www.un.org/esa/population/publications/longrange2/WorldPop2300final.pdf>

<sup>12</sup> International Panel on Climate Change. (2014). *Climate change 2014: Impacts, adaptation, and vulnerability*. Retrieved 24 April 2014 from [www.ipcc.ch/report/ar5/wg2/](http://www.ipcc.ch/report/ar5/wg2/)

<sup>13</sup> The term 'bioeconomy' includes all industries and branches of the economy that produce, manage or otherwise harness biological resources (and related services, supply or consumer industries), such as agriculture, food, fisheries and other marine resources, forestry. Source: European Union. (2012). *FP7 Cooperation Work Programme Food, Agriculture and Fisheries, and Biotechnology*. [http://www.ec.europa.eu/research/participants/data/ref/fp7/132093/b-wp-201301\\_en.pdf](http://www.ec.europa.eu/research/participants/data/ref/fp7/132093/b-wp-201301_en.pdf)

<sup>14</sup> Industrial biotechnology enables industries to deliver novel products which cannot be produced by conventional industrial methods; in addition it will make possible replacing chemical processes by more resource efficient biotechnological methods with reduced environmental impact (Source: *ibid.*).

## Global trends shaping the forest industry

The macro environment for the forest industry is distilled in the ESTEMPLE analysis presented in Table 1. Major trends and drivers of the industry's future are described in more detail below.

ESTEMPLE ANALYSIS OF THE MACRO-ENVIRONMENT FOR THE NEW ZEALAND FOREST INDUSTRY	
<b>Economic</b>	<ul style="list-style-type: none"> <li>• New Zealand well aligned to growing and emerging economies, including North Asia, India and ASEAN block</li> <li>• Export demand for logs boosts prices and forest grower returns; global shortfall in softwoods by 2020 or earlier</li> <li>• Demand for solid wood and wood fibre products improving with domestic and US economies; log prices squeeze margins</li> <li>• Deforestation-afforestation sensitive to carbon prices and competing land use (dairy) returns</li> <li>• Māori are increasing (e.g. Central North Island) and reducing (Ngāi Tahu) investment in forestry</li> <li>• New Zealand currency overvalued on fundamentals creating pressure for exporters; volatility (3-5 year) dissuades investors</li> </ul>
<b>Social</b>	<ul style="list-style-type: none"> <li>• Forestry worker health and safety a major concern; impacts attractiveness of forest industry careers</li> <li>• Closure of (mostly) older, smaller mills impacts rural regions</li> <li>• Low skills, high (Māori) youth unemployment in forestry regions - Northland, East Coast, Western Bay of Plenty</li> <li>• Social licence to operate adversely impacted by harvesting log debris and sediment in waterways</li> </ul>
<b>Technological</b>	<ul style="list-style-type: none"> <li>• Global trend towards low 'carbon' renewables; natural products; lightweighting and zero waste</li> <li>• Engineered wood products, prefabrication building systems grow demand for solid wood; reduce labour constraints</li> <li>• ICT - broadband, hands-held devices, big data, sensors - integrate across value chain and enable precision systems</li> <li>• 3-D printing, robots and automation, design and logistics redefine manufacturing</li> <li>• Biotechnologies - primary and industrial - taps the latent potential of genomes and enables sustainability</li> </ul>
<b>Ecological</b>	<ul style="list-style-type: none"> <li>• Global trend towards renewable energy and green chemicals; clean technologies and zero waste</li> <li>• Natural resources (forests) become scarce as world population and wealth grows to increase fibre and energy insecurity</li> <li>• Bans on illegal logging and requirement for certification is reducing tropical log hardwood supply</li> <li>• Valuation and monetisation of forest ecosystem services for carbon, biodiversity, avoided erosion (polluter pays)</li> <li>• Weed and pest control costs rising; NGO certification systems constrains use of proven chemicals and genetic engineering technology</li> </ul>
<b>Media</b>	<ul style="list-style-type: none"> <li>• Social media has powerful influence on licence to operate and public perceptions of forestry</li> <li>• Anti-science lobby achieves disproportionate media 'voice' reflecting weak citizen science, e.g. genetic engineering technology</li> <li>• News is global, real-time and easily accessed (information age)</li> </ul>
<b>Political</b>	<ul style="list-style-type: none"> <li>• Government Business Growth Agenda to increase exports to 40% of GDP by 2025</li> <li>• Treaty of Waitangi settlements nearing completion; rapid growth of the Māori economy including in forestry</li> <li>• Australia-New Zealand Closer Economic Relations and new Federal legislation provides scope for increased forest industry R&amp;D collaboration</li> <li>• China-New Zealand Free Trade Agreement has profoundly increased trade and investment flows</li> </ul>
<b>Legal</b>	<ul style="list-style-type: none"> <li>• New national framework for freshwater management set nutrient limits that will drive land management change</li> <li>• Changes to Resource Management Act will strengthen Hazardous Substances and New Organisms Act (and national governance of introduced organisms; genetic engineering technology)</li> <li>• Race to own-secure intellectual property for the renewable bioeconomy including forest biomass technologies</li> </ul>
<b>Ethical</b>	<ul style="list-style-type: none"> <li>• Advocacy group concerns about new technology such as genetic engineering and nano-technology</li> <li>• Protection of privacy, information security and cyber-espionage in a digital age</li> </ul>

Table 1: An ESTEMPLE analysis of the macroenvironment for the New Zealand forest industry.

**Global transition to renewable, low carbon substitutes for petroleum products; the 'greening' of business:** The potential for wood fibre to be converted into chemicals and polymers and thereby substitute for petrochemicals is now well recognised. The production of renewable polymers and composite materials from biomass is a rapidly growing global opportunity<sup>15</sup>. These materials, developed from renewable feedstocks, such as from forests, have properties

comparable to non-renewable oil-based plastics. Global production of bioplastics, for example, is currently about 1.4 million tonnes per annum (in a 200 million tonne per annum plastic market) and is forecast to expand to 6.2 million tonnes per annum by 2017. New Zealand has the ability to produce these plastics from trees and waste fibre from other biomass processing and local companies are increasingly seeking to take up this opportunity.

<sup>15</sup> European Bioplastics. (2013). *Bioplastic facts and figures*. Retrieved 23 April 2014 from <http://en.european-bioplastics.org/>



Multi-nationals such as Unilever, Procter and Gamble, IKEA, Nestlé and other members of the Sir Richard Branson initiated B Team<sup>16</sup> are driving a change to procurement of renewable inputs to their products and services. Automobile companies too are moving toward lightweight, renewable materials to improve energy efficiency, safety and reduce GHG emissions and other adverse environmental impacts. Demand for bioproducts continues to expand rapidly in both the OECD and emerging economies. This is supporting the growth of New Zealand companies involved in developing biobased products such as composites, renewable chemicals and packaging based on forest (plant) extracts. Renewable chemicals markets are projected to reach US\$59 billion next year. The bioproducts category is forecast to expand to €200 billion in seven years. Several bioproducts were identified in the WoodScape study<sup>17</sup> as having the potential to support a step change in economic returns from a tree. This understanding is directing Scion's investment into bioproducts and bioenergy.

**A growing need for affordable housing and resilient commercial building solutions:** Demand continues to grow for improved and affordable housing in New Zealand and developing economies in Asia, India, the Middle East, Africa and South America. Over the next decade new flooring equivalent to the land area of Austria will be laid in response to population growth, urbanisation and increased wealth<sup>18</sup>. Multi-rise and in-fill building within cities will increase. Wood is a well proven construction material for these purposes and in earthquake prone regions. As outlined in the Woodco Strategic Action Plan, there is the potential to substantially extend the application of wood and wood-derived materials into future houses.

Bans on illegal logging and certification of forests will change global markets: Australia<sup>19</sup> and the EU introduced legislation to ban 'illegal' logging in 2012. Only authenticated logs will be able to enter these markets. This will further reduce supplies of illegally harvested tropical hardwoods and presents an opportunity for New Zealand's certified plantation forests and expansion of the area planted in hardwoods such as eucalypts and indigenous species. This also adds impetus to Scion's (and others) work on log traceability in the supply chain and automatic scaling; and an opportunity to adapt technology and practice from the livestock industries (e.g., NAIT) and Global Standards (GS1) initiative.

**Big data<sup>20</sup> and information communication technologies are transforming business and science:** The rapid evolution of 'data intensive science' - sensors, robotics, geospatial mapping - is dramatically and rapidly changing both the landscape under which science is conducted and the manner in which science engages with industry and policy agencies. Data intensive science represents a paradigm shift from hypothesis/experimentation based science, to

one of identifying patterns in data; and using modelling and simulation tools with increasingly large volumes of data. These developments are allowing science providers to use existing science data resources more efficiently as well as having datasets available nationally and internationally. This can help drive productivity improvements through information sharing along value chains, faster genetic gains and tree growth in forests, increased log conversion rates in mills and higher quality consumer solutions (e.g., high quality, energy positive, prefabricated homes).

**Meeting greenhouse gas emission reduction and forest conservation (biodiversity) targets:** The United Nations sponsored REDD+ scheme (which, from a New Zealand perspective, will beneficially reduce log supply from tropical hardwood forests), land use change and the protection of biodiversity are means to meeting these targets. A greater use of wood and wood-derived products in buildings will also support a reduction in greenhouse gases and aligns to the international trend toward using materials with low-embodied energy. Forest plantings are highly sensitive to government policy, such as the Climate Change Response Act 2002. The 2012 amendment to this Act significantly reduced forest planting intentions for winter 2013<sup>21</sup>. Low carbon returns also affect Māori who are considering whether to continue land lease arrangements or manage their own forests. A study<sup>22</sup> published in 2013 suggests a further 39,000 hectares of deforestation may occur by 2020. A reduced area in plantation forests decreases New Zealand's ability to benefit from impending global shortfalls in softwood supply and to meet its GHG emissions reduction targets. Poorer security of log supply by the late 2020s may also deter new investment in processing. Growing the competitiveness of forestry as a land-use, including through short rotation special purpose species, therefore remains a high priority for Scion.

**Ensuring energy security and safety:** Higher oil exploration costs in environmentally sensitive zones (such as national parks and deep oceans), growing concerns about air pollution due to coal, the rapid deployment of fracked gas (especially in the US), and political unrest in the major oil producing regions are leading economies to implement energy security strategies to reduce both sovereign risk and GHG emissions. Also nuclear power plants, once foreseen as a lead option for improving energy security, are either closing (Japan, Germany) or their construction is being delayed (France, Finland, China). These trends are particularly pressing for countries with a high dependence on imported energy, such as China, India, South Korea and Japan, which are important trading partners for New Zealand. The New Zealand Government's energy strategy seeks to generate 90% of electricity from renewable sources by 2025 and have a 50% reduction in greenhouse gas emissions from 1990 levels by 2050<sup>23</sup>. Wood already

<sup>16</sup> The B Team. (2013). *People, planet and profit: doing business for the wellbeing of the planet and people*. <http://bteam.org/>

<sup>17</sup> Woodco. (2013). *WoodScape Study - Technologies and Markets*. Retrieved 18 March 2014 from <http://www.woodco.org.nz>

<sup>18</sup> Dobbs, R., Remes, J., Manyika, J., Roxburgh, C., Smit, S., & Schaer, F. (2012). *Urban world: Cities and the rise of the consuming class*. (p. 3). McKinsey Global Institute.

<sup>19</sup> Australia passed laws in 2012 to ban the import and trade of illegally logged timber, joining the United States and European Union in clamping down on a global trade in stolen timber that Interpol says is worth about \$30 billion a year.

<sup>20</sup> The term 'big data' is used for a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. The challenges include capture, curation, storage, search, sharing, transfer, analysis and visualisation. The trend to larger data sets is due to the additional information derivable from analysis of a single large set of related data. Source: [http://www.en.wikipedia.org/wiki/Big\\_data](http://www.en.wikipedia.org/wiki/Big_data)

<sup>21</sup> Provisional estimates of tree stock sales and forest planting in 2013. Source: <http://www.mpi.govt.nz>

<sup>22</sup> Manley, B. (2012). *Deforestation Survey 2011: Final report*. (Technical Paper 2012/11). Wellington, New Zealand: Ministry of Agriculture and Forestry.

<sup>23</sup> Ministry of Economic Development. (2011). *New Zealand Energy Strategy 2011-2021*.

<http://www.med.govt.nz/sectors-industries/energy/pdf-docs-library/energy-strategies/nz-energy-strategy-lr.pdf>

provides some 7.2% of New Zealand's energy and, through technology advances in converting forest biomass to sugars and better use of forest and wood residues, has the potential to increase its contribution to New Zealand's energy supply by a further 24 petajoules. The Primary Growth Partnership 'Stump to Pump' programme is the largest current near-market initiative in New Zealand. The UK and EU in particular are continuing their focus on meeting 2020 greenhouse gas reduction targets through renewable energy technologies.

**New technologies such as genetic modification (GM), industrial biotechnology and precision production systems are helping to address the challenge of achieving sustainable growth from finite natural capital:** The application of these technologies is accelerating to optimise resources (e.g., water and nutrient efficiency), reduce chemical use (e.g., herbicides and pesticides) and incorporate valuable commercial traits faster than by conventional breeding (e.g., the volume and quality of plant yields). Technologies such as drone derived LiDAR information for precision forest management and scanning to optimise log selection and conversion value are rapidly gaining wider acceptance for use in the New Zealand forest industry.

**New protocols and standards for packaging:** New Zealand must also provide high quality packaging materials to enable our primary produce exports, such as those from horticulture and aquaculture, to meet the new global packaging protocols and satisfy the requirements of increasingly sophisticated consumers in high value international markets. Typically, packaging materials must be disposable (challenging some traditional packaging materials such as expanded polystyrene), while also maintaining the quality and safety of the transported material such as fruit, fish and dairy products. To address these needs, new packaging solutions are required, providing a dual benefit to New Zealand by developing new materials from our forest fibre resources and an essential technology platform to support our high-value food export industry. The Green Growth Strategy noted the necessity for New Zealand export companies to reduce the carbon footprint of their products in order to stay competitive<sup>24</sup>. Hence, substitution of expanded polystyrene with a compostable bio-based packaging material<sup>25</sup> derived from wood fibre (such as for moulded or extruded products<sup>26</sup> within the fast-moving consumer goods sector) presents a significant new manufacturing opportunity for New Zealand.

**More enquiries for non-radiata forest species:** Radiata pine represents some 90% of New Zealand's commercial forests and will remain the dominant species for the foreseeable future. However, Māori and other forestry investors (and New Zealand's competitors) have a growing interest in other species to supply naturally durable timbers to expanding Asian markets, provide short fibre species for paper, and avoid the need for chemical treatments. KPMG (2013) estimated annual revenue streams from indigenous species could grow to \$285 million per annum. Reducing the health risk of a forest monoculture and adapting to climate change are other drivers of interest in non-radiata

species. These drivers provide the impetus for Scion to increase effort in eucalypts, cypresses, Douglas-fir, kauri, beech and totara and to extend our understanding of export markets and supply chains for high-value wood product exports.

## The forest industry and Scion in 2025 - a preferred future<sup>27</sup>

By 2025 the New Zealand forest industry is strongly capitalising on the global economic, environmental and societal changes described in the previous sections. The planted area of forests has expanded to 2.1 million hectares (including 0.3 million hectares of previously under-utilised Māori land) from the 2014 area of 1.7 million hectares. Compared to now, these plantations include a more diverse range of species (including indigenous), have genotypes matched to the environments they are most suited too (such as East Coast forests' exposure to severe drought owing to the effects of climate change); and the first commercial plantings of some new breeding technology/GM herbicide tolerant and sterile trees are growing well. Replacement and new forest plantings average 70,000 hectares per annum. Owners of radiata pine forests achieve 10-25% productivity gains by optimising tree genetics to particular environments and sites and the use of clones; and the uniformity of these forests at harvest could be 25-40% greater than those planted in 2014.

Remote sensing for forest management is normal; harvesting, pruning and other operations are fully mechanised and almost 50% of all forest operations are automated; trees are fully traceable and segregated for their best use and highest value in the supply chain. Special purpose forests with an eight-year rotation and MAI of 40m<sup>3</sup>/hectare per annum have been established for energy, green chemical and other purposes. These forests are sometimes established in high wind risk areas.

Wood processors have consolidated into internationally competitive clusters and are integrated across the value chain to exploit synergies in forest biomass flows; enable specialisation and grow the total value from all components of a log. Māori are co-investors with offshore investors in wood processing and directly manage some 25% of forests and own 50% of the land on which forests are grown. Geothermal energy provides significant competitive advantage to central North Island and Northland wood processors. Low emissions energy and water availability, together with at least 65% log conversion rates and profitable products from saw and pulp mill residues, contribute to more than 80% of log being processed onshore.

The mix of processed products and 'customer solutions' has expanded to include new wood-based

<sup>24</sup> Green Growth Advisory Secretariat. (2011). *Greening New Zealand's Growth*. Wellington, New Zealand.

[http://www.med.govt.nz/sectors-industries/environment/pdf-docs-library/Greening New Zealand's Growth.pdf](http://www.med.govt.nz/sectors-industries/environment/pdf-docs-library/Greening%20New%20Zealand's%20Growth.pdf)

<sup>25</sup> Biopolymer Network; <http://www.biopolymernetwork.com>

<sup>26</sup> Woodforce; <http://www.woodforce.com>

<sup>27</sup> The 2025 vision comprises information from the Woodco Strategic Action Plan, industry association R&D plans, and science and technology trends.

composites, plastics, natural preservatives; packaging that doubles food shelf life; green chemicals and renewable energy products, including a 'drop-in' biodiesel. Several automobile and homeware companies have extensively adopted Sonae's Woodforce technology (originally licensed from Scion in 2011) into their cars to exploit its lightweight, strength and reusability. Prefabricated wood construction utilising a range of engineered wood technologies (produced to tight specifications) dominates the housing market; has a 25% share of the commercial building sector and earns \$1 billion in exports. Scion's dewatered wood technology is the preferred substitute for hardwood in three ASEAN economies. Dairy farmers use 40,000 tonnes of molasses (sugar) by-product from a new high performance pulp technology, and trees are highly valued on lowlands by non-forest land owners for their environmental benefits and income stream from the monetisation of carbon and biodiversity ecosystem services.

Scion is New Zealand's 'shop window' to the world's leading biomaterial-renewable futures research institutes; is a strategic partner with several multi-nationals that have a large influence on wood-fibre and 'wood-food-fed' value chains. More than 30% of Scion's revenues are derived from commercialisation; it has international eminence for thought leadership and science quality (H-index > 100); 15% of its staff are of Māori descent; the ICT section represents 20% of the workforce and its value chain economics, systems and design capability is national leading.

The New Zealand public hold the forest industry in high esteem for its environmental integrity, innovativeness and socially responsible corporate leadership. Companies regularly report 'zero' harm to their staff; top talent preferentially seek careers in forest-related firms.

## Scion's stakeholders' plans for the forest industry

New Zealand forest industry organisations each have growth and development strategies and associated science and innovation plans. These provide critical direction to Scion and the focus of this SCI. They include:

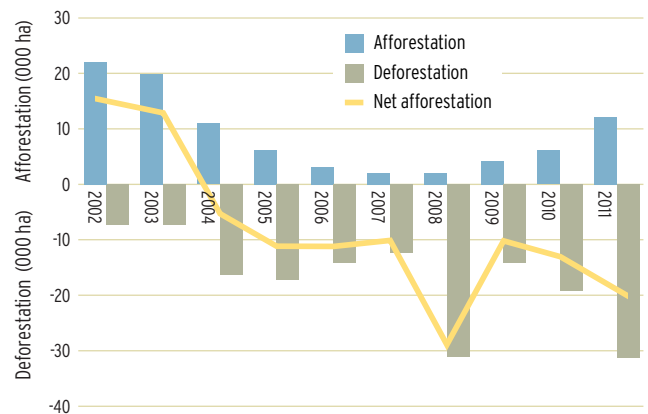
### The New Zealand Forest and Wood Products Strategic Action Plan:<sup>28</sup>

The New Zealand Wood Council's (Woodco) target is to grow wood-based products to \$12 billion (\$4.8 billion in 2010/11) and the value of forest technologies to at least \$2 billion annually by 2022. This will be achieved by:

- New Zealand wood becoming the preferred construction and finishing product in New Zealand and Australia.
- Expanding exports of New Zealand wood into Asia, India, USA and Australia.
- Delivering more value from the existing resource.

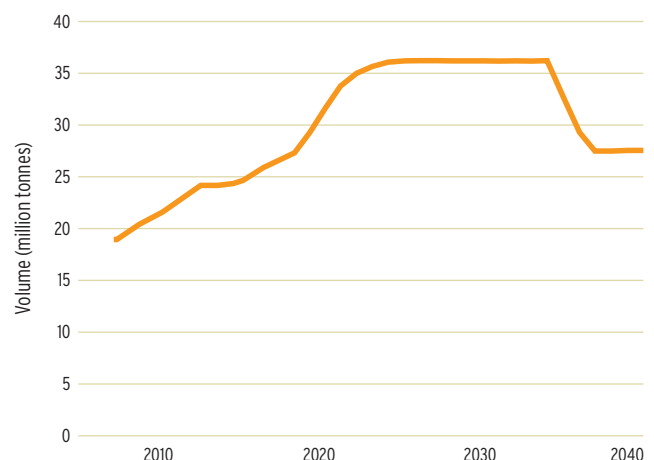
- Transforming the use of wood in building systems.
- Expanding new high-value fibre products and integrating new co-product value streams such as biochemicals, biofuel and other bioenergy options.
- Developing new fibre-based packaging products to support New Zealand growing high-value food exports.

### YEARLY AFFORESTATION AND DEFORESTATION 2002-2011



Deforestation is occurring in New Zealand. Source: *Wood Matters*; Issue 57, September, 2013. Source: MPI - National Exotic Forest Description, April 2012.

### NEW ZEALAND RADIATA PINE VOLUME



Wood supply insecurity is a big concern for wood processors. New Zealand harvest volumes showing steep decline in log supply late 2020's. (Source: MPI)

**New Zealand forest owners:** The New Zealand Forest Owners Association (NZFOA), in its Science and Innovation Plan<sup>29</sup>, has stated an ambition to grow the forest sector by \$3 billion by 2030. The key to this will be improved profitability through the doubling of productivity (biomass production) on a per hectare basis while also improving wood quality (uniformity and stiffness) and increasing tree resistance to pests and diseases. Forest growers including those from the Farm Forestry Association (FFA) voted to support the introduction of a commodity levy in March 2013.

<sup>28</sup> Wood Council of New Zealand Inc. (2012). *New Zealand Forest and Wood Products Industry Strategic Action Plan*. Retrieved 23 April 2014 from <http://www.woodco.org.nz>

<sup>29</sup> Forest Owners Association. (2012). *New Zealand Science and Innovation Plan*. Retrieved from 23 April 2014 from <http://www.nzfoa.org.nz>

Collection commenced on 1 January 2014 and is projected to raise an estimated \$6.7 million per annum (with approximately 50% allocated to research) in the 2014 calendar year. New industry structures (e.g., a Trust Board and R&D Committee) have been established to oversee the use of levy funds. The levy, while modest in scale compared to the sector's earnings, will provide more certainty and flexibility for industry good research such as increasing forest productivity and protecting tree health.

**The Wood Processors Association/Pine Manufacturers Association (WPA/PMA) Science and Innovation Plan**<sup>30</sup> targets annual gains of \$100 million per annum through increases in export revenue and improvements in manufacturing processes. The Wood Processors Association and the Pine Manufacturers Association will merge from July 2014 to form a single point of co-ordination for wood and wood fibre processors. This will place them in a better position to also introduce a levy and coordinate with forest growers. Woodco continues as the forest industry's umbrella organisation.

Important factors implicit to the NZFOA (and FFA) and WPA/PMA plans are:

- While the genetic make-up of trees to be harvested over the next 20-30 years is already determined, the replanting of up to 50,000 hectares<sup>31</sup> provides significant scope to now influence the genetic quality and diversity of species in New Zealand's future forest estate.
- The relativity between the many types of value trees generate, owing to the trends outlined above, is expected to change significantly over the next two decades. Such values include timber, carbon, fibre, energy, chemicals, land use optimisation, biodiversity, recreation and nutrient reduction.
- Wood offers superior environmental credentials and hazard resilience compared to steel and concrete in a carbon-constrained world and in earthquake-prone zones, respectively.
- Forestry strongly complements New Zealand's other primary production sectors providing wind shelter, carbon, erosion and nutrient mitigation, and sustainable packaging. Increased integration of land-use, genetic improvement and manufacturing would be beneficial.
- A more prosperous future for the forest industry requires integration along the value chain, and the matching of feedstocks with end-uses.

**Māori aspirations for the forest industry:** The Crown/Māori strategy for economic development, *He Kai Kei Aku Ringa*, was released in October 2012. The associated action plan (2012-2017) emphasised the importance of Māori building meaningful science collaborations with CRIs and universities,

and of improving the performance of their land and other assets. A 2013 report on *Growing the productive base of Māori freehold land* indicates that at least 470,000 hectares is best suited to forestry. Both opportunities are aligned with Scion's Māori Plan (see Figure 7) to grow the Māori economy through forestry. Māori have more than \$2 billion of assets in forestry<sup>32</sup> with about 500,000 hectares of pre-1990 forests. As Treaty settlements conclude, Maori ownership of land and forests will increase. However, Maori have challenges with:

- Fragmentation of land ownership (circa 550,000 hectares of Māori land has no formal administration).
- Remoteness from processing sites and associated transport costs.
- Accessing working capital for forest establishment.
- Managing intergenerational investment.
- Implementation of the Emissions Trading Scheme.
- Developing local employment opportunities for their people.

Proposed changes to the Te Ture Whenua Māori Act 1993 should assist Māori to realise their aspirations<sup>33</sup>.

Some Māori forest owners wish to diversify species and, in some cases, re-establish land in species other than radiata pine (including kauri, totara and beech). Their desire to re-establish taonga species is part of their cultural reinvigoration, for carbon revenue and ngahere for traditional uses. They are also interested in creating multi-layered forests to generate several income streams (from ginseng, honey, essential oils, wood and carbon for example).

In considering the use of forest resources, Māori also strongly want to incorporate Mātauranga Māori (traditional knowledge) and increase the education and skills of iwi/hapū members. Science and innovation are seen as enablers of a strengthened future Māori economy. A number of iwi/Māori are currently pursuing the use of science, innovation and technology strategies to better understand the potential benefits for iwi economic, social (cultural) and environmental outcomes.

As Māori increase their influence over land and forests they will play a greater role in shaping the future New Zealand forest industry than in the past. Accordingly, through forestry "There is enormous potential for the Māori economy to lead aspects of growth in the New Zealand economy"<sup>34</sup>.

**Central Government:** The Government's goal is to foster economic development that will deliver greater prosperity, security and opportunities to all New Zealanders. The centrepiece for this is the Business Growth Agenda<sup>35</sup> which constitutes six inter-linked "ingredients" for business

<sup>30</sup> Wood Processors Association of New Zealand and New Zealand Pine Manufacturers Association. (nd). *Wood Processing and Manufacturing Science and Innovation Plan*. <http://www.pine.net.nz/resources/LatestNews/WoodProcessingandManufacturingScienceandInnovationPlan.pdf>

<sup>31</sup> Provisional estimates of tree stock sales and forest planting in 2013. Source: <http://www.mpi.govt.nz>.

<sup>32</sup> Nana, G., Stokes, F., & Molano, W. (n.d.). *The Asset Base, Income, Expenditure and GDP of the 2010 Māori Economy*. Wellington, New Zealand: Māori Economic Taskforce. <http://berl.co.nz/assets/Economic-Insights/Economic-Development/Maori-Economy/BERL-2011-The-Asset-Base-Income-Expenditure-and-GDP-of-the-2010-Mori-Economy.pdf>

<sup>33</sup> Te Puni Kōkiri. (2013). *Discussion document: Te Ture Whenua Māori Act 1993 Review Panel*. <http://www.tpk.govt.nz/en/in-print/our-publications/publications/te-ture-whenua-maori-act-1993-review-panel-discussion-document/download/TTWMA-discussion-document.pdf>

<sup>34</sup> Te Puni Kōkiri. (2012). *Māori Economic Development Panel Discussion Document*. [http://www.tpk.govt.nz/\\_documents/medp-discussiondocfinal-2012.pdf](http://www.tpk.govt.nz/_documents/medp-discussiondocfinal-2012.pdf)

<sup>35</sup> Ministry of Business, Innovation & Employment. (n.d.). *Business Growth Agenda*. Retrieved 18 March 2014 from [www.mbie.govt.nz/what-we-do/business-growth-agenda](http://www.mbie.govt.nz/what-we-do/business-growth-agenda)



growth: export markets, innovation, infrastructure, skilled and safe workplaces, natural resources, and capital. Each of these has its own programme of work and they impact the way Scion works with government departments such as:

- The Ministry for Primary Industries (MPI) which has the responsibility for forest and trade policy, implementation of the Emissions Trading Scheme, biosecurity, and administers the Primary Growth Partnership (PGP).
- The Ministry of Business Innovation and Employment (MBIE) and New Zealand Trade and Enterprise (NZTE). MBIE has responsibility for business growth, building and housing, timber and wood treatment standards, energy policy, development of key markets such as China and India, and science and innovation policy and implementation.
- The Ministry for the Environment (MfE) which is responsible for environmental policy and regulation regarding forests (e.g., the national policy statements for forestry, water and biodiversity, the Land and Water Forum), climate change policy, aspects of local government; and, through the Environmental Protection Agency (EPA), the HSNO Act which is central to the approval of Scion's genetic modification research.
- The Department of Conservation (DoC) in forest conservation management, biodiversity protection, weed, fire and pest management.
- The Ministry of Foreign Affairs and Trade (MFAT) in addressing forest biosecurity risks, global standards and market access protocols, and access to international markets through science diplomacy.

**Callaghan Innovation**<sup>36</sup> was established as a Crown Agent on 1 February 2013 and represents a fundamental shift in the Crown's focus for growing the high-value manufacturing sector and innovation by firms. Scion signed an MoU with Callaghan Innovation in June 2013. Scion is now the largest provider of manufacturing research and development among the Crown Research Institutes, which represents a significant opportunity to boost its "high end" wood and wood fibre manufacturing and bioproduct development research. Callaghan Innovation will also assist Scion to translate its expertise and technology (such as for renewable packaging and bioenergy products for household consumer goods) into other industries.

**National Science Challenges launched:** The Government announced 10 National Science Challenges on 1 May 2013<sup>37</sup>.

These challenges provide new impetus to connect science providers to tackle 'big' national problems. Scion is participating in four of the challenges including 'New Zealand's biological heritage', 'Our land and water', 'Science for technological innovation' and 'Resilience to nature's challenges'. As outlined later, these will begin to impact Scion's programmes and core funding investment from late 2013. The eleventh challenge, 'Building better homes, towns and cities', is highly relevant to Scion's capabilities and may be initiated during 2014.

**Local government:** Local government has a significant role in forestry owning 3% of the national estate. The local government sector consists of 11 regional councils, 61 territorial authorities (11 are city councils and 50 are district councils) and six unitary councils, which are territorial authorities with regional council responsibilities. Research priorities for regional councils<sup>38</sup> relevant to the forest industry include integrated land and freshwater management, nutrient and contaminant management, hazard management including climate change mitigation and adaptation; and hazard risk mapping, air quality, valuation of ecosystem services, planning and monitoring tools for the management of cumulative effects and for integrating decision making across scales (from the forest (or farm) to catchment to region). The Bay of Plenty and Waikato Regional Councils' plans with regard to forestry are especially significant in the near term for Scion. For example, Scion has helped shape the Bay of Connections Strategies pertaining to forestry<sup>39</sup> and energy development<sup>40</sup>. Improving water quality, whether for the Waikato River or Rotorua Lakes, is a significant challenge for these regions. Scion will continue to work closely with the local government sector to address these needs.

## Forest industry stakeholder priorities

Forest industry stakeholders' priorities have been distilled from industry and government department input into Scion's strategy workshops, discussions with industry leaders, the ESTEMPLE analysis and industry association R&D plans presented earlier, the Shareholders' Outlook Letter to Crown Research Institutes, the Government's Business Growth Agenda and public sector requirements. These are summarised in Table 2 and highlight commonality of purpose in areas such as forest plantings, log supply security and climate change adaptation. Other priorities are distinct to a sector, such as the need to find an acceptable, cost effective alternative to methyl bromide for fumigation of export logs.

<sup>36</sup> Callaghan Innovation; <http://www.callaghaninnovation.govt.nz>.

<sup>37</sup> Ministry of Business, Innovation & Employment. (n.d.). *National Science Challenges*. Retrieved 18 March 2014 from <http://www.msi.govt.nz/update-me/major-projects/national-science-challenges/>

<sup>38</sup> Envirolink. (n.d.). *Research Strategy*. Retrieved 18 March 2014 from <http://www.envirolink.govt.nz/Research-Strategy/>

<sup>39</sup> Bay of Connections. (2011). *Bay of Plenty Forestry and Wood Processing Strategy*.

[http://www.bayofconnections.com/downloads/Forestry\\_and\\_Wood\\_Processing\\_Strategy\\_September\\_2011.pdf](http://www.bayofconnections.com/downloads/Forestry_and_Wood_Processing_Strategy_September_2011.pdf)

<sup>40</sup> Bay of Connections. (2011). *Bay of Plenty Energy Strategy*. [http://www.bayofconnections.com/downloads/Energy\\_Strategy\\_December\\_2011.pdf](http://www.bayofconnections.com/downloads/Energy_Strategy_December_2011.pdf)

## FOREST INDUSTRY KEY STAKEHOLDER PRIORITIES

<b>Forest owners/ Farm foresters</b>	<ul style="list-style-type: none"> <li>• Make forestry more competitive as a land use</li> <li>• Forest protection (biosecurity; wind, fire hazards)</li> <li>• Improve operating/supply chain efficiency</li> <li>• Improve worker health and safety</li> <li>• Licence to operate-steepland harvesting</li> <li>• Reduce dependence on China log market; credit risk</li> <li>• A cost effective alternative log fumigant to methyl bromide</li> <li>• Alternative species diversification options</li> </ul>	<b>Wood processors</b>	<ul style="list-style-type: none"> <li>• Log supply security and pricing</li> <li>• Increased profitability (new products; efficiency; customer solutions)</li> <li>• Modernise building standards for wood products and keep them current</li> <li>• Improve international market access and trade terms (level playing field)</li> <li>• Economic 'stability' to encourage investment in mills, plant and equipment</li> <li>• Raise earnings through design-led and IP protected innovation</li> </ul>
<b>Māori - tangata whenua</b>	<ul style="list-style-type: none"> <li>• Finalise Treaty settlements</li> <li>• Generate sustainable wealth from primary sector assets; develop under-utilised land</li> <li>• Employment and higher living standards for Māori</li> <li>• Vision Mātauranga Māori integrated into R&amp;D; partnerships with Scion-research providers</li> </ul>	<b>Forest investors (domestic-foreign)</b>	<ul style="list-style-type: none"> <li>• Meet Weighted Average Cost of Capital and target portfolio returns</li> <li>• Forest protection (biosecurity; wind, fire hazards)</li> <li>• Increase asset (forest) value</li> <li>• Enable liquidation of assets</li> </ul>
<b>Government</b>	<ul style="list-style-type: none"> <li>• Meet business growth agenda targets</li> <li>• More jobs and higher wages</li> <li>• Land-use intensification within limits</li> <li>• Affordable housing</li> <li>• Rebuild Christchurch</li> <li>• Value for money (impact) from R, S&amp;T and increased collaboration (NSC) across science system</li> <li>• Callaghan Innovation formed to accelerate the commercialisation of innovation by firms</li> </ul>	<b>NZ Wood Council (Woodco)</b>	<ul style="list-style-type: none"> <li>• Achieve \$12 billion exports by 2022 by processing 70% logs onshore</li> <li>• Improve regional infrastructure to reduce logistics costs</li> <li>• Encourage (and enable) wood use domestically</li> <li>• Establish clear and consistent policies for land use and land investments</li> <li>• Support a skilled and safe workforce</li> </ul>

Table 2: Forest industry key stakeholder priorities.

### Shareholders' guidance

The Government has identified 'science and innovation' as the main driver of a modern, future-looking economy and one of the six 'planks' in its economic growth agenda. Shareholding Ministers expect Scion to clearly articulate how it will achieve its Statement of Core Purpose outcomes, work openly and collaboratively with open science providers, establish a performance framework for core funding, ensure easy access and reuse of data held by CRIs, ensure early and high uptake of new knowledge and technology to maximise its impact in regional development and for New Zealand, and maintain financial viability.

### Scion's response

With this strategic and operating context in mind, Scion has developed its strategy and science and innovation plan to directly address the priorities above and, in so doing, support forest growing, wood and wood-derived products manufacturing companies, new investors and new companies meet their growth and other performance targets. Scion's strategy, and science and innovation plan are described in the following section.

# 3. Scion's strategic priorities

Scion's 2014-19 strategy builds on the proven foundations laid in 2012. It was formatted in the balanced scorecard approach as shown in Figure 3. The strategy is designed to deliver the science and technologies required by Scion's stakeholders to address their critical challenges and

priorities as described in Section Two and summarised in Table 2, respectively. In particular the strategy seeks to:

1. Support the forest industry to achieve its long-term potential and contribution to New Zealand.

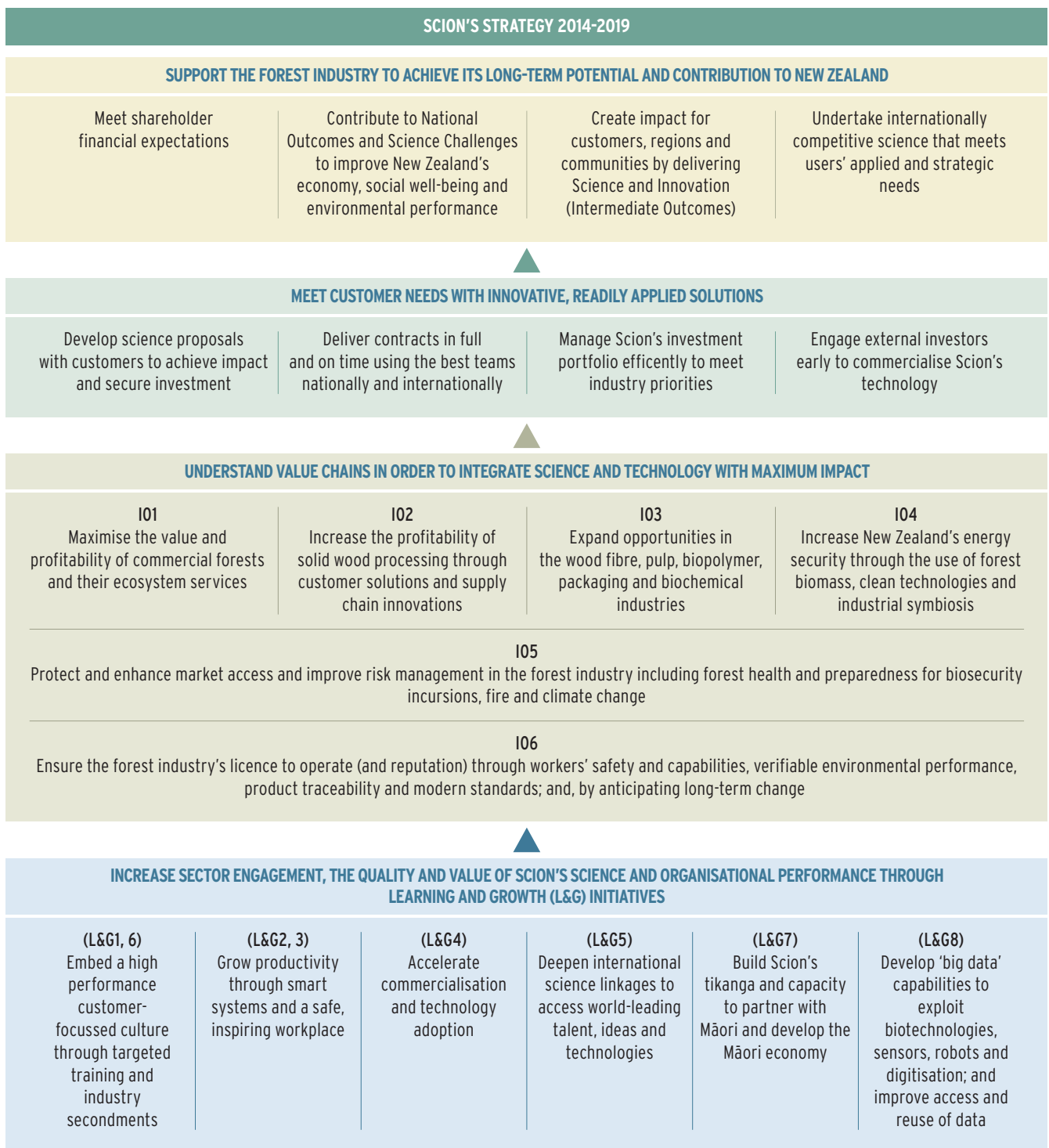


Figure 3: Scion's strategy mapped in a balanced scorecard format.

2. Meet customers' needs in the forest industry and biomaterials sector with innovative, readily applied solutions.
3. Understand value chains in order to integrate the new knowledge and technology arising from Scion's six Intermediate Outcomes (IOs) with maximum impact.
4. Increase Scion's engagement with forest industry sectors, the quality and value of Scion's science and organisational performance through Learning and Growth (L&G) initiatives.

Specific initiatives within each of these four inter-related themes are shown in the text boxes. For example, with respect to science quality, Scion's goal is to "Undertake internationally competitive science that meets users' applied and strategic needs", and with respect to increasing technology transfer through commercialisation Scion will "engage external investors early to commercialise Scion's technology". Learning and Growth (L&G) initiatives are areas where Scion needs to develop its capabilities, infrastructure, systems, networks and relationships in order to fulfil its strategy. L&G4, for example, to "accelerate commercialisation and technology adoption" builds skills in commercialisation. Scion's operating plan, prepared annually, specifies objectives to be completed for each of these initiatives during the financial year concerned. Monitoring and reporting to the Board is via a scorecard set of performance indicators that mirror the strategy.

## Phasing the execution of Scion's strategy

Each year, particular areas of Scion's strategy are prioritised for additional management focus and investment through the Annual Operating Plan. Since the introduction of the CRI Taskforce (including core funding) reforms in 2011, Scion has progressed from building its internal capabilities - culture, systems and capacity (2011-2012) - to increasing the alignment and impact of its research through more effective transfer and commercialisation of technology, building national and international collaborations, and supporting regional development (2012 onwards) as illustrated in Figure 4. Matching the pace of organisational change, and prioritising investment accordingly is a critical success factor in increasing Scion's contribution to the forest industry and New Zealand, and building its reputation as a world-class research provider.

Scion's priorities over the 2014-19 period are described below. In several cases these are supported by the reinvestment of Scion surpluses (see page 42 for an overview of the proposed reinvestment portfolio).

**Priority 1. Value chain optimisation:** The New Zealand forest industry has a highly fragmented value chain and information flows are generally poor between the main actors. This leads to inefficiency, averaging of prices and lack of improvement in quality. The main challenge for manufacturers of high price (>\$3000/m<sup>3</sup>) and margin radiata pine products is reliability of wood supply to specification. Increased capacity to supply to specification is essential<sup>41</sup> if New Zealand is to de-commoditise from logs and 'old style' wood products. Also a culture change within the industry is required, and that is a challenge when the ability to apply pricing signals within value chains is poor. Further,

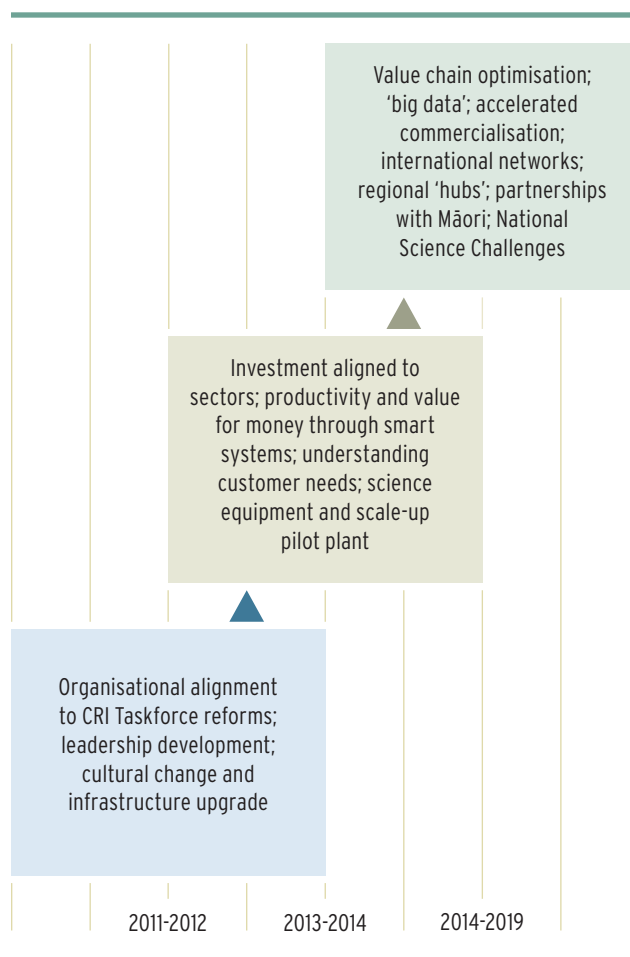


Figure 4: Evolution of Scion's strategy and implementation priorities.

supply chains are increasingly global and non-linear; and logistics considerations, such as port hubs and forms of storage, are critical for export success. Understanding who captures value ('makes money'), in order to target science and technology interventions where innovation may be most successful, is a prerequisite to lifting the impact of Scion's research.

To support a value chain approach Scion proposes to:

1. Appoint staff with specialist, quantitative analysis and translation expertise to the Value Chain Optimisation Science Team formed in 2011.
2. Adopt tools and frameworks to help staff understand the value chain context in which their work is to be placed. This includes expanded techno-economic modelling such as that applied to the bioenergy, biosolids waste (TERAX™) and WoodScape studies.
3. Work closely with firms and customers in order to understand the 'real' world of prices, costs, barriers and enablers within the supply chains they function.

**Priority 2. Accelerate commercialisation:** More effective commercialisation of Scion's technologies will increase its research impact and financial resilience. In addition to lead technologies TERAX™ (reducing municipal wastes) and

<sup>41</sup> Jacobides, M. G., & MacDuffie, J. P. (2013, Jul - Aug). How to drive value your way. *Harvard Business Review*, 94 - 99.



Woodforce (Sonae; wood plastics<sup>42</sup>), Scion has a pipeline of more than 40 technologies across the value chains it is engaged with. These include modified wood products, renewable energy technology, composite materials, superior genotypes and decision support tools. Customers and investors are engaged with us in all of these technologies. We have adopted a Charter with Callaghan Innovation to assist with the commercialisation of technologies and their application to other sectors.

To further improve commercialisation and rapid uptake of its technologies, Scion will:

1. Further systemise pipeline management of technologies to ensure resources are aligned to projects with the greatest potential impact.
2. Invest in 'larger' game changing technologies such as the Woodforce wood plastic pellet and TERAX™ biosolids waste technologies (see L&G4 in Figure 3) as well as technologies that contribute to 'smaller-scale, incremental gains' in forest and mill productivity (e.g., decision support tools for farm foresters, camera vision technology for forestry worker safety).
3. Seek new sources of investment for technology commercialisation along with Callaghan Innovation and Bay of Plenty investors such as Te Arawa Group Holdings, Quayside and Enterprise Angels.
4. Extend Scion's pilot plant infrastructure (such as a supercritical CO<sub>2</sub> plant for modified wood) in order to scale-up and de-risk technologies for investors.
5. Develop staff expertise in technology commercialisation through tailored workshops and secondments to firms and mentoring (L&G1 and L&G6).
6. Improve the post-commercialisation management of Scion's licensed technologies such as the 'A Grader' used in New Zealand and North American sawmills.
7. Attract tenants with new technology, capital and expertise to Scion's North Drive Innovation Park and the Rotorua District 'forest industry centre of excellence' (see Priority 5 overleaf).

**Priority 3. Develop international networks:** Building strong international linkages with world-leading research providers in the forestry, wood processing and bio-based products sectors provides significant strategic and technical advantages to New Zealand firms and ensures Scion can leverage its organisational capabilities with the resources of others. Scion will remain conscious of the ongoing choices between invention and adaptation and the implied cost implications. In addition, Scion offers a rare combination of multi-disciplined skillsets spanning the value chain that are attractive to many non-New Zealand stakeholders.

Scion intends to implement a Learning and Growth initiative (L&G5, Figure 3) to deepen its international network through staff exchanges/sabbaticals, formal agreements at both a technical and strategic level, coordination of funding applications to leverage co-investment opportunities, and establishing structured mechanisms for open information exchange, fast-tracking business/technical opportunities and strategy co-development. This includes establishing:

1. Innovation Exchange Fora with partners to share new ideas and opportunities.

2. An Ideas Factory to provide quick-turnaround, proof-of-concept testing for technical or business concepts.
3. Offering a "Best Team Guarantee" to customers by maintaining a multi-disciplinary talent pool through our international research networks.

**Priority 4. National Science Challenges:** The National Science Challenges (NSC) represent a significant change in the operating model for New Zealand science. Scion is engaged in four (likely five by late 2014) of the NSCs as illustrated in Figure 5.

During the SCI planning period, Scion expects to:

1. Finalise its role and begin functioning within the first four (of 10) NSCs.
2. Support the planning and initiation of the 'Better homes, towns and cities' NSC.
3. Use defined pathways to apply the NSC mission-led science for the forest industry and biomaterials sector (e.g., apply fundamental phytophthora research in the 'Biological heritage' NSC to mitigate threats to plantation forests and species with commercial potential such as kauri and threat of PTA induced dieback).

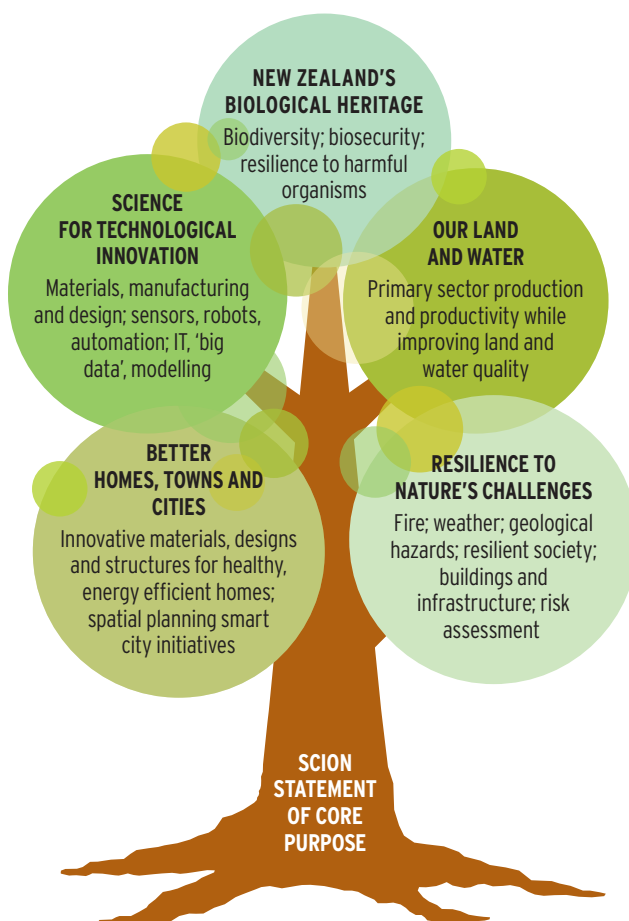


Figure 5: The five National Science Challenges most aligned to Scion's core purpose.

<sup>42</sup> See <http://www.woodforce.com/> for details about this product.

- Utilise synergies between NSCs such as new materials from the Science and Technological NSC and building innovative, energy efficient, smart prefabricated homes.

**Priority 5. Regional hubs and development:** Scion is closely involved in forming a Rotorua 'forest industry cluster' to support district and regional economic development, and subsequent spill-over national benefits. The cluster concept draws together the Bay of Plenty tertiary education initiative, Rotorua District Council and GROW Rotorua economic development initiatives, forest industry firms, and iwi with substantial interests in forests in the Central North Island. Scion has secured a \$2.5 million interest free loan from the Bay of Plenty Regional Council Infrastructure Fund to construct an 'Innovation Centre Building' on its North Drive Innovation Park (Figure 6). Occupancy is expected in 2015.

During the planning period Scion expects to:

- Fully tenant the new innovation centre building and generate synergies between the 27 companies already located on the Te Papa Tipu Campus.
- Work closely with GROW Rotorua (and Rotorua District Council), Bay of Plenty Connections (and Bay of Plenty Regional Council) and Industrial Symbiosis Kawerau (ISK)<sup>43</sup> to support economic development initiatives. For example, 35% of all forest stocks are in the Bay of Plenty Regional Council) and Industrial Symbiosis Kawerau (ISK)<sup>43</sup> to support economic development initiatives. For example, 35% of all forest stocks are in the Bay of Plenty

region. In 2010 forestry contributed to 10% of the Bay of Plenty's GDP and was a significant and positive attractant for employees<sup>44</sup>. By 2020 the region's annual harvest is forecast to be 2-3 million m<sup>3</sup> per annum greater than at present. This increase in log supply requires new processing capacity and, equally important, innovation to achieve export competitive wood and wood fibre products;

- Work closely with the Bay of Plenty tertiary education alliance (Waiariki Institute of Technology, Bay of Plenty Polytechnic and the University of Waikato) to foster initiatives such as a university-led 'freshwater centre of excellence' to be based in Rotorua and boost the number of postgraduate students studying at Scion.

**Priority 6. Partnerships with Māori:** As described in Section 2, Māori are increasing their ownership of forests and forest lands in New Zealand. An estimated 1.2 million hectares of this is underutilised<sup>45</sup>. Their ability to realise economic value from such lands and forests is constrained by the parcels of land or forests they control typically being below economic critical mass, shortages of technical and Governance expertise and insufficient working capital. Māori also want to undertake operations and develop products in a manner that respects Māori values, utilises Mātauranga Māori (traditional knowledge) and ensures environmental sustainability (kaitiakitanga). Scion's Te Papa Tipu Māori Plan (Figure 7) addresses these primary issues. The plan and progress in implementing it is assessed annually by Scion's strategic Māori Panel (Ngā Rangatira Rōpu).



Figure 6: Initial concept drawing of the 'Innovation Centre Building' scheduled for construction on Scion's North Drive Innovation Park early 2015 and the Rotorua District Council's 'forest industry centre of excellence' logo which encapsulates the Bay of Plenty tertiary sector alliance and forest industry stakeholders not located on Scion's campus.

<sup>43</sup> Kawerau District Council. (n.d.). *Industrial Symbiosis Kawerau*. Retrieved 24 April 2014 from [http://www.kaweraudc.govt.nz/Economic\\_Development/industrialsymbiosiskawerau.asp](http://www.kaweraudc.govt.nz/Economic_Development/industrialsymbiosiskawerau.asp)

<sup>44</sup> Ministry of Business, Innovation & Employment. (2013). *Regional economic development report* (pp. 22-23), <http://www.mbie.govt.nz/pdf-library/what-we-do/business-growth-agenda/rear/REAR%20Publication.pdf>

<sup>45</sup> Ministry of Primary Industries. (2013). *Growing the productive base of Māori freehold land*. Retrieved 18 March 2014 from <http://www.mpi.govt.nz/Default.aspx?TabId=126&id=1734>

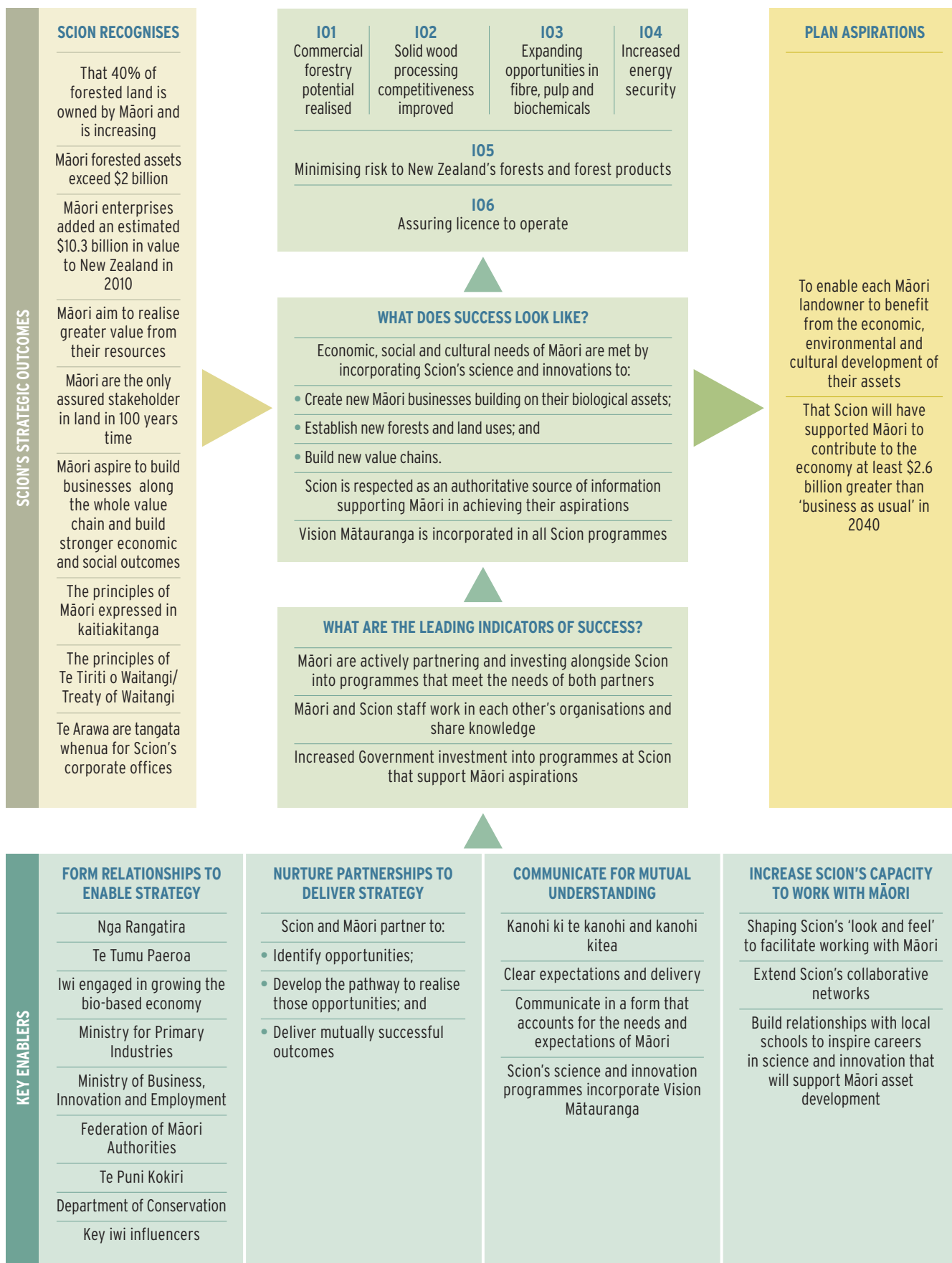


Figure 7: Scion's Te Papa Tipu Māori plan 2014-2019.

The first two years of the plan focussed on building Scion's internal capabilities, relationships with iwi with forest assets, and implementing research projects.

Scion's priorities to grow the Māori economy through forestry are:

1. Build partnerships (including with 'cooperating clusters') to support greater economic returns for Māori from their participation in the forest industry).

2. Develop communication channels within Māoridom.
3. Customise technology translation to best meet Māori needs.

These initiatives align fully with "*He Kai Kei Aku Ringa*"<sup>46</sup>, the strategy developed by the Crown Māori Economic Growth Partnership.

<sup>46</sup> Māori Economic Development Panel. (2012) *Strategy to 2040, He kai kei aku ringa*, [http://www.tpk.govt.nz/\\_documents/medp/He-Kai-Kei-Aku-Ringa-Strategy.pdf](http://www.tpk.govt.nz/_documents/medp/He-Kai-Kei-Aku-Ringa-Strategy.pdf)



# 4. Scion's science plan

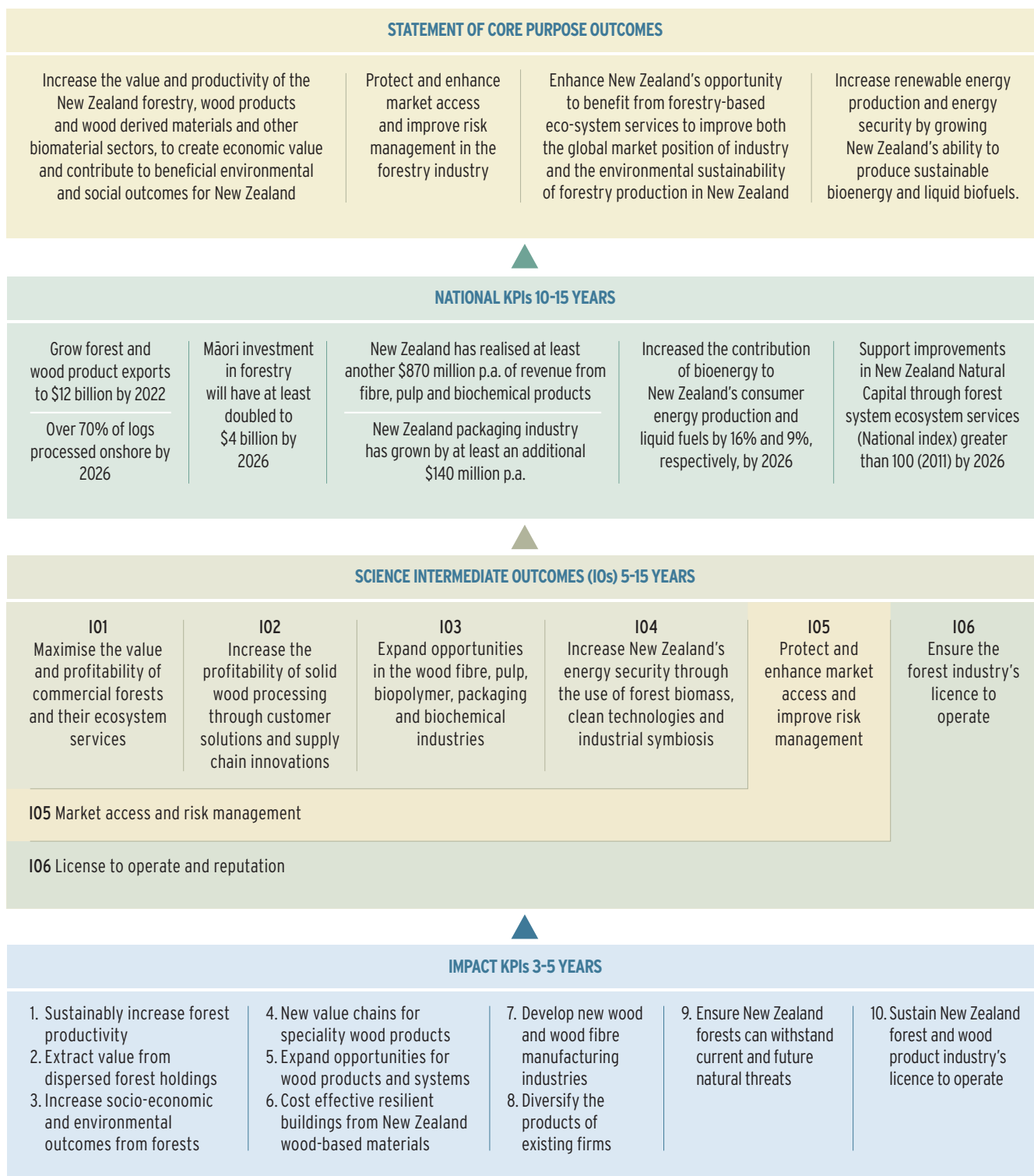


Figure 8: Scion's Science Plan shows the inter-dependency between National and Intermediate Outcomes and performance measures (National and Impact KPIs respectively).

As described in the strategy map (Figure 3), Scion's science is focussed on delivering six interrelated Intermediate Outcomes (IOs)<sup>47</sup>:

- IO1: Maximise the value and profitability of commercial forests and their ecosystem services.
- IO2: Increase the profitability of solid wood processing through customer solutions and supply chain innovations.
- IO3: Expand opportunities in the wood fibre, pulp, biopolymer, packaging and biochemical industries.
- IO4: Increase New Zealand's energy security through the use of forest biomass, clean technologies and industrial symbiosis.
- IO5: Protect and enhance market access and improve risk management in the forest industry including for forest health and preparedness for biosecurity incursions, fire and climate change.
- IO6: Ensure the forest industry's licence to operate (and reputation) through workers' safety and capabilities, verifiable environmental performance, product traceability and modern standards; and, by anticipating long-term change.

Each IO is described more fully in the following section. The integrated delivery of these, as illustrated by Figure 8, will achieve Scion's Statement of Core Purpose national outcomes. Strategic Advisory Panels<sup>48</sup> to the Scion Board, established in 2011, provide independent and expert perspectives on science quality, user impact and Māori and assist with strategy formulation.

## Science plan alignment to Scion's Statement of Core Purpose outcomes

Scion's Science Plan (Figure 8) describes the inter-dependence between Core Purpose national outcomes and Intermediate Outcomes (IOs) that will be delivered by Scion. The IOs are targeted at a 5-15 year horizon. Scion and its research partners provide the enabling tools, technologies and knowledge that will enable users to achieve the impacts for industry and thus Scion's Core Purpose national outcomes. Each IO has 1-3 impact measures (Key Performance Indicators (KPIs) that are to be achieved within a 3-to-5 year timeframe by which progress towards IO achievement is gauged. The hierarchy and performance framework for achieving national outcomes is illustrated in Figure 9 along with the principal stakeholder(s) responsible for delivering each output or outcome.

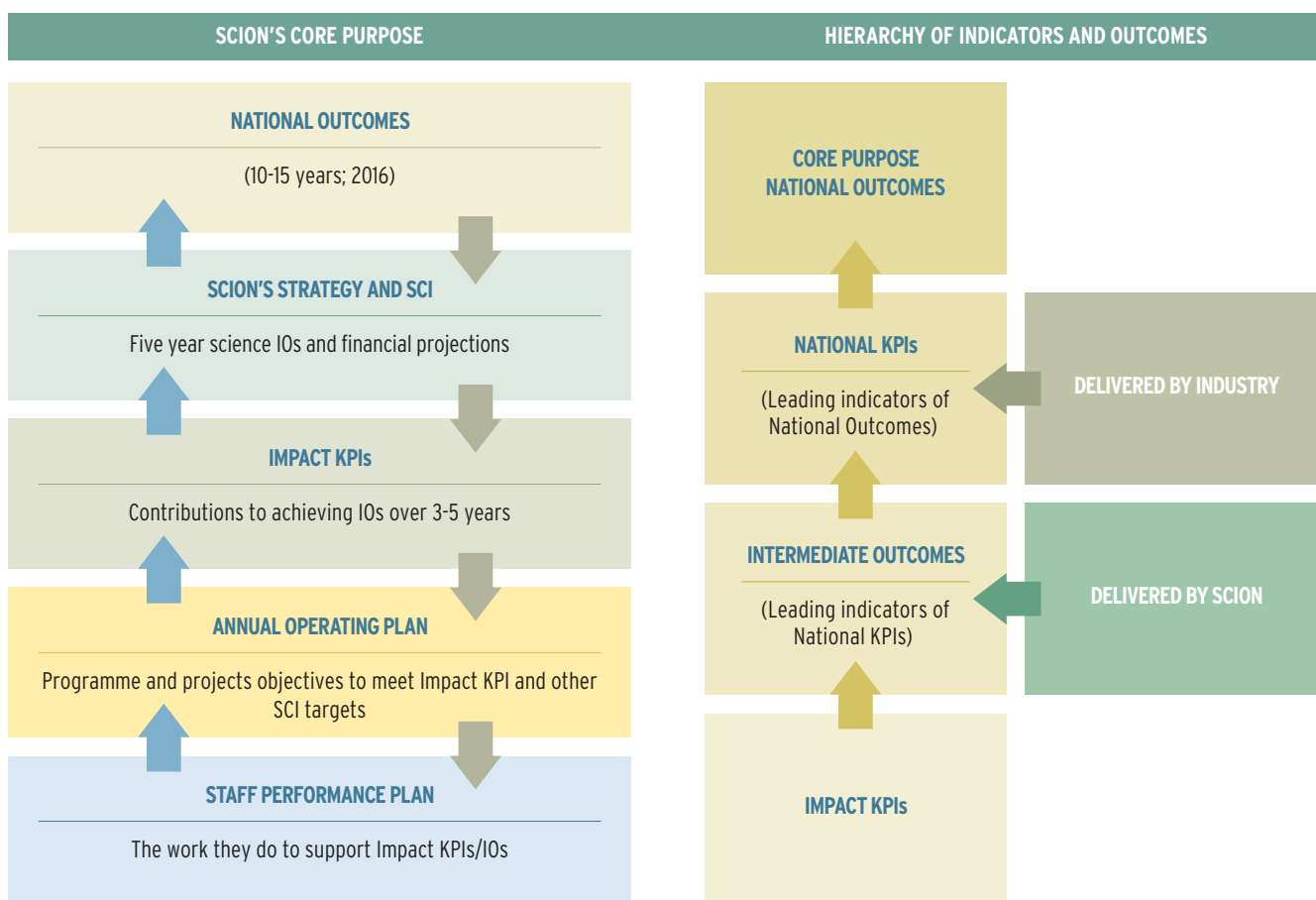


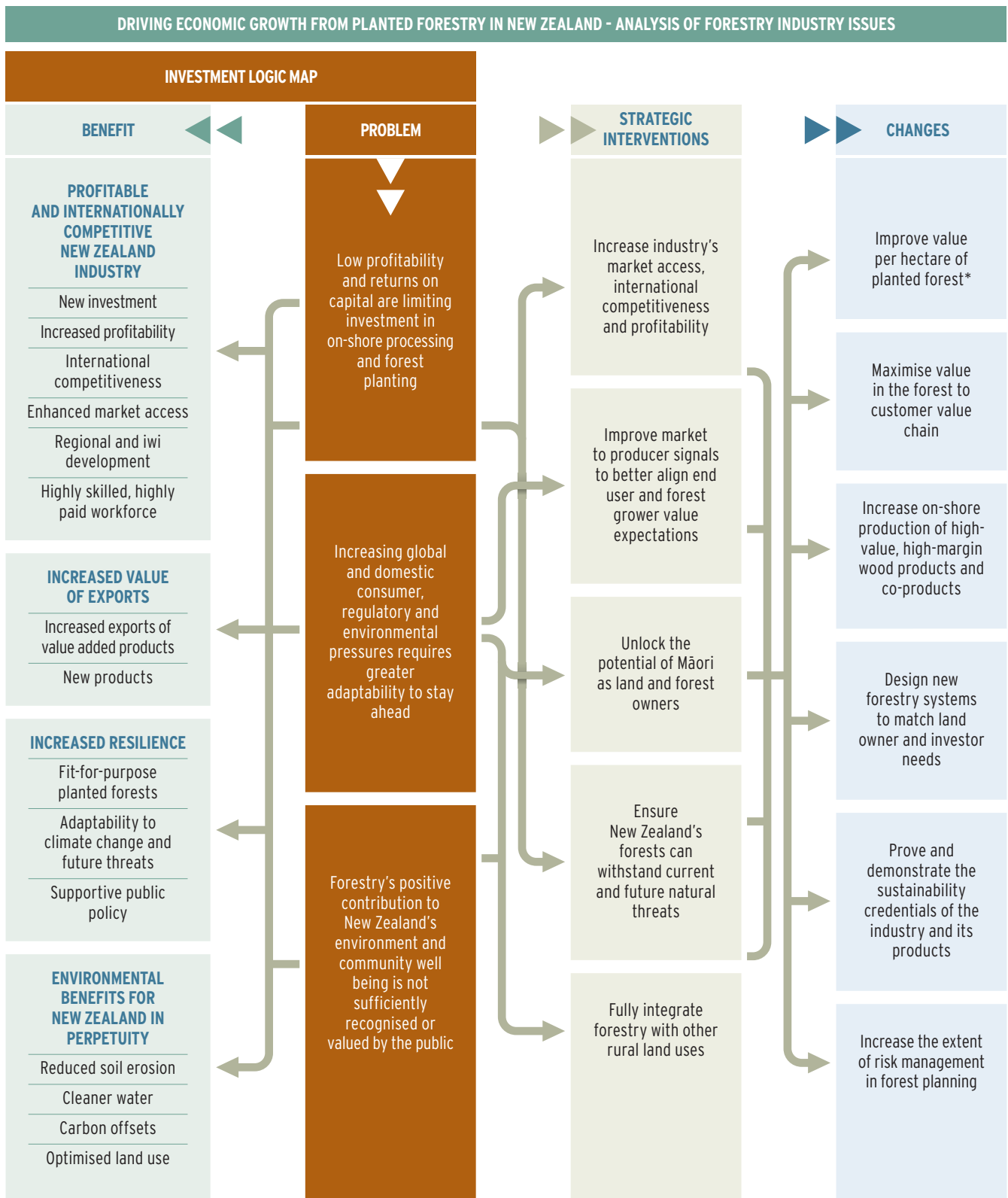
Figure 9: Alignment of Scion's science IOs, Impact KPIs and staff performance plans with Core Purpose national outcomes and where accountability for implementation lies.

<sup>47</sup> These are the science outcomes that Scion can directly influence that support and lead to delivery of the industry targets.

<sup>48</sup> The terms of reference of these groups and their composition are available at <http://www.scionresearch.com>

Direct input of industry and policy agencies into the science programmes for each IO is a high priority for Scion. In recent years, a powerful mechanism for collating stakeholder needs and priorities has been facilitated through intervention logic mapping workshops. An

example for the forest growing sector, prepared in 2012 for the large, multi-year investment proposal to MBIE, is shown in Figure 10. Similar logic maps for other sectors have been prepared and are regularly reassessed with stakeholders.



\* Such as through site productivity, wood quality, consistency and uniformity and good forest health.

Figure 10: An investment logic map prepared with forest grower stakeholders during 2012 to design a proposal to MBIE for a six year programme of research investment.

# 5. Scion's investment priorities and allocation of core funding

Scion receives \$17.73 million of CRI Core Funding (core funding) from the Government to invest in science programmes that will contribute towards the achievement of its Statement of Core Purpose national outcomes. The allocation of core funding is updated annually to reflect refreshed industry strategies, science progress and changes in the external operating environment.

Core funding is focussed on:

- Ensuring Scion's capability is aligned with the delivery of impact measures (KPIs) for each Intermediate Outcome (the IO Impact KPIs are summarised in the bottom row of Figure 8).
- Supporting activities where direct industry investment is unlikely until proof of concept is demonstrated and the risks are quantified.
- Growing industry co-investment through joint business cases.
- Improving the competitiveness of Scion's science capability and equipment.

Scion has a well defined process and criteria for allocating (and monitoring the performance of) core funding investments. Specifically:

- Allocations are made to science programmes, each of which contributes to the delivery of at least one Impact KPI and at least one IO.
- Investment is based on the contribution of the science, the balance of research and risk across the six IOs/ Impacts and meeting special requirements such as the stewardship of critical capability or databases and collections. From July 2014, core funding will be segmented into three categories: funds mapped into the National Science Challenges, funds allocated to the maintenance of databases, collections and underpinning infrastructure, and funds supporting Scion's Core Purpose research programmes.
- Programmes are funded in accordance with the research plan but not for more than seven years.
- Between 5 to 10% of Scion's investment will be refreshed each year to provide for new opportunities, emerging science, collaborations and capability building. Refreshment occurs by reallocating across IOs as well as within IOs.
- The investment process and monitoring of portfolio 'health' is managed by Scion's Research and Investments Office in conjunction with the Science General Managers, and, through the CEO, accountable directly to the Scion Board.
- Programmes are broken down to objectives in the Annual Operating Plan and progress in meeting them is reported

monthly through Scion's scorecard. In addition, performance is checked quarterly by the Research and Investments Office and formally reviewed at least triennially by the Scion Board, Strategic Advisory Science, User and Māori Panels. As well, internal science reviews are completed to varying degrees for all programmes to ensure they remain correctly targeted.

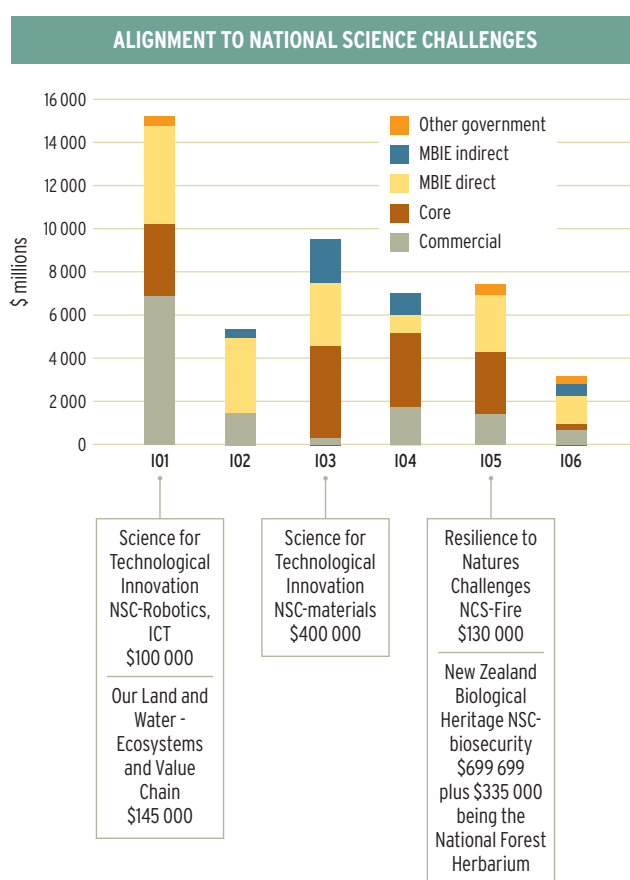


Figure 11: Investment (\$) directed to achieve each Intermediate Outcome (IO) and the investment Scion is making into the National Science Challenges.

## Investing in delivering Scion's strategic outcomes (Intermediate Outcomes)

In addition to core funding, Scion receives investment from the Ministry of Business Innovation and Employment science investment funds directly (contracts that Scion holds with MBIE) and indirectly where Scion is a sub-contractor to an MBIE contract. Investment is also received from other government departments such as the Ministry for Primary Industries and from commercial firms. All these investments are aligned to achieving Scion's strategic



outcomes (IOs). The mapping of investment to these IOs is shown in Figure 11. Overlaps between investments and outcomes should be noted. For example, an investment into tree genetic improvement (linked to IO1) may also improve tree health and thus resistance to a biosecurity incursion (linked to IO5). Core funding is aligned to the IO where the investment has the largest impact. Figure 11 also indicates the value of core funding linked to a National Science Challenge.

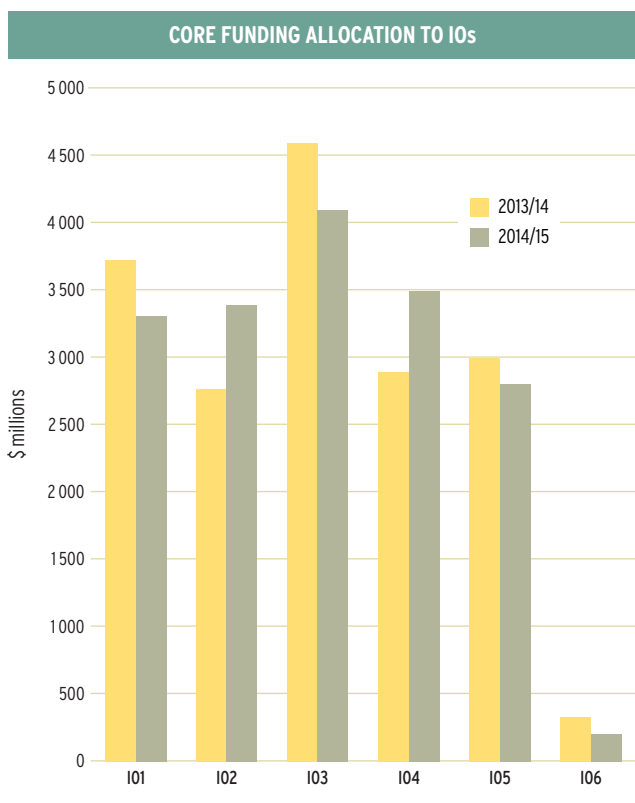


Figure 12: Core funding allocation to IOs showing between year changes.

Changes to the allocation of core funding occur both between and within IOs (Figure 12). The latter typically are more substantial (up to 20%) as science programmes are adapted for new findings from the research conducted at Scion (and the wider research community) and in response to changes in the market place and the priorities of firms. Programme leaders are encouraged to make changes as the year progresses rather than rely on the annual review. Core funding is also targeted to strategic development of

capability at Scion, notably at present in Value Chain Optimisation, Forest Industry Informatics and Resource Economics (forest ecosystem services and natural capital assessment). Some core funding is aligned to the National Forest Herbarium and Database (\$350k) and in 2014/15 the nationally significant Permanent Sample Plot (PSP) Database will receive \$50k to help mitigate the loss of MBIE contestable funding from 1 October 2013 of almost \$1m for alternative forest species research.

The following section describes the Intermediate Outcomes, the approach underpinning delivery of each of these outcomes and the leading indicators (Impact KPIs) in delivering these outcomes.

## Intermediate Outcomes and Impact Key Performance Indicators

Scion's IOs and the underpinning approach to deliver these are derived from six key strategies developed by Scion's major stakeholder groups (described in Section 1). Specifically:

1. The New Zealand Forest and Wood Products Industry Strategic Action Plan. The Wood Council of New Zealand: [www.woodco.org.nz](http://www.woodco.org.nz)
2. New Zealand Forestry Science and Innovation Plan, New Zealand Forest Owners Association January 2012: [www.nzfoa.org.nz](http://www.nzfoa.org.nz)
3. The New Zealand Farm Foresters Association: [www.nzffa.org.nz](http://www.nzffa.org.nz)
4. He Kai Kei Aku Ringa The Crown Māori Economic Growth Strategy specifically focussing on realising greater value from Maori owned economic resources: [www.tpk.govt.nz](http://www.tpk.govt.nz)
5. Wood Processing Science and Innovation Plan; New Zealand Wood Processors and Manufacturers Association 2012: [www.nzwpa.org.nz](http://www.nzwpa.org.nz)
6. New Zealand Government's Business Growth Agenda: [www.mbie.govt.nz](http://www.mbie.govt.nz)

## Measuring progress against Scion's strategic outcomes

Progress in meeting the IO goals will be assessed through the achievement of 10 leading performance indicators (Impact KPIs). The IOs are interdependent to varying degrees, as are the leading indicators. Thus, Impact KPIs contribute to one or more IOs as illustrated in Figure 13.

MEASURING PROGRESS AGAINST SCION'S STRATEGIC OUTCOMES

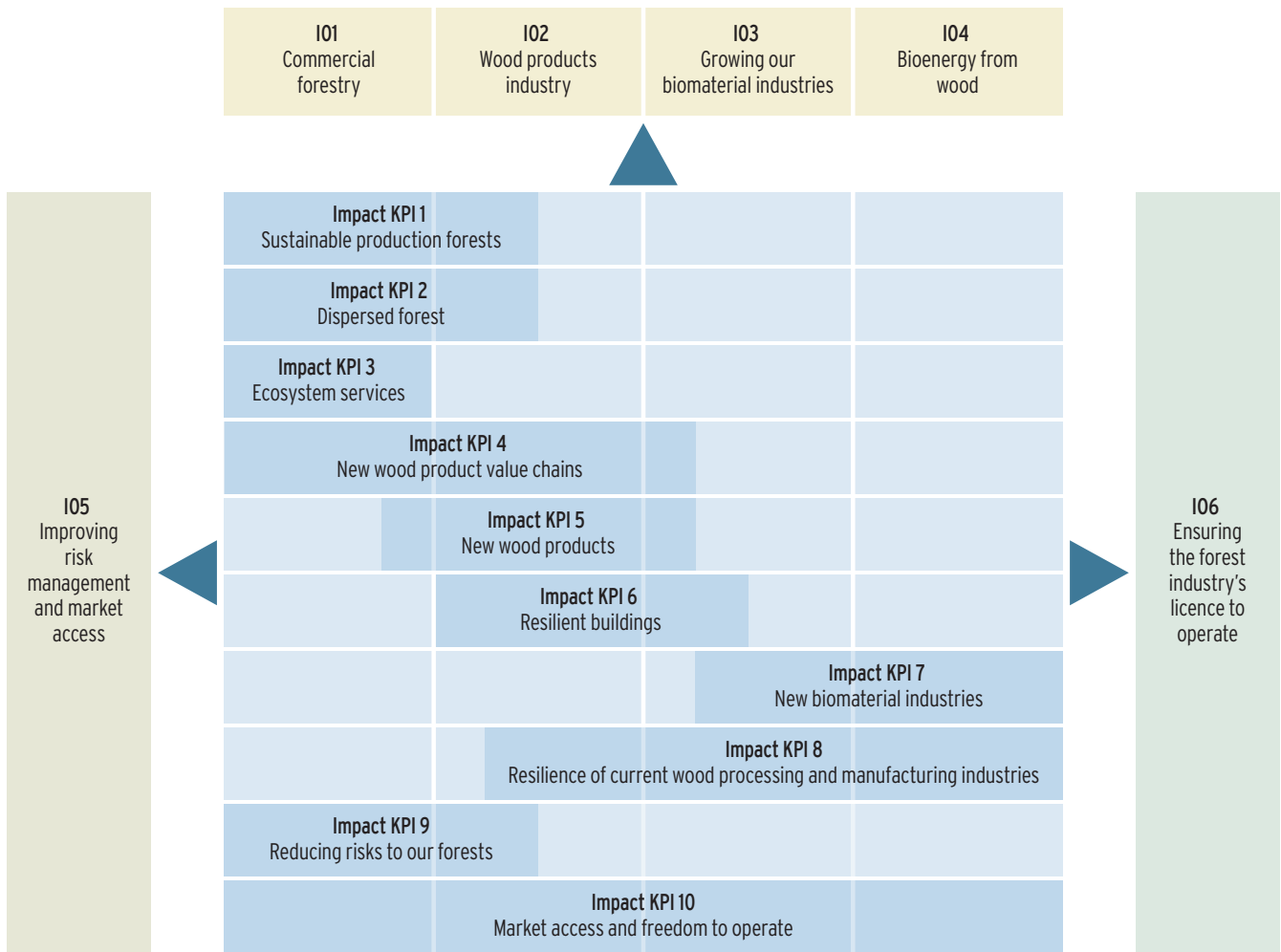


Figure 13: Map of Impact KPIs against Intermediate Outcomes showing their relative contribution to outcomes and interdependencies. A strong indicator is shown in 'darker blue'; a secondary indicator is shown in 'light blue'.

### IO1: Maximise the value and profitability of commercial forests and their ecosystem services

By 2026 Scion will have provided technologies, tools and materials to support the industry to increase competitiveness of the commercial forest estate through at least 50% increase in forest biomass productivity (Mean Annual Increment (MAI)) and at least \$70 million per annum reduction in operational costs over 2010 values, leading to growth in planted area from its present 1.7 million hectares.

To achieve the above we will support forest growers, farm foresters, Māori, wood manufacturers and Government in their ambitions to enhance the value created and derived from forestry, and to expand and diversify New Zealand's forests. Specific aims are to:

- Increase the volume, value and diversity of exports derived from our forests.
- Encourage investment in forestry and wood processing by providing security of supply of high quality wood.

- Enable the cost-effective and environmentally sustainable recovery of logs from steep country and small woodlots where at least 40% of the wood supply will arise in the near future.
- Expand forests onto otherwise under-utilised land and in-particular support monetisation of the contribution that forests make to environmental and community well-being (ecosystem services).
- Enable sustainable growth rate (MAI) to improve profitability of forestry along the value chain - from land-use to market (Table 3 illustrates the impact of increasing MAI).
- Reduce the proportionately large cost of harvesting in the forest-to-mill supply chain.
- Improve worker safety.

#### Alignment to the National Science Challenges

- Our land and water - ascribing value to forestry to enhance the resilience of our land and fresh water resources
- Science for technological innovation - increasing use of 'big data' for productivity gains in forestry.

300 Index	Site Index (m)	Rotation age (years)	Total recoverable volume (m <sup>3</sup> /ha)	MAI (m <sup>3</sup> /ha/yr)	Carbon sequestered (t/ha)	Stumpage (\$/ha)	NPV (\$/ha)
28	27.9	25	577	27.2	786	36 555	3 094
28	27.9	30	758	29.8	1 003	50 579	2 755
28	27.9	35	923	31.1	1 204	63 452	2 001
32	30.4	25	675	31.8	911	41 482	3 740
32	30.4	30	863	33.9	1 131	54 981	3 119
32	30.4	35	1 033	34.7	1 333	66 998	2 167

Table 3: Impact of forest biomass accumulation rate (Mean Annual Increment; MAI) and age at harvest on returns by hectare (Stumpage and NPV at a discount rate of 8%) and carbon storage for a pruned radiata pine forest regime<sup>49</sup>.

## Impact KPI-1: Sustainably increase the productivity of New Zealand forests

By 2019 tools, novel forest management approaches and new plant material will be embedded into New Zealand's forests and forestry practices to support the industry's target to increase radiata pine Mean Annual Increment from an average of 20 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup> to 40 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup> and in a way that enhances the sustainability of forest growing in New Zealand. Leading indicators are:

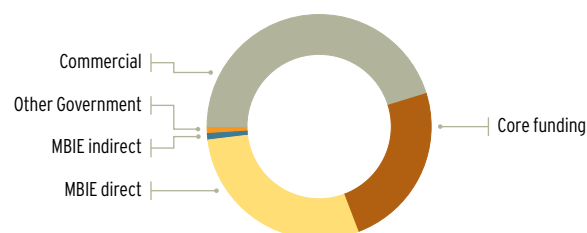
- By 2016 Scion will have quantified the gap between current productivity and potential productivity that could be achieved if key limiting factors could sustainably be overcome. This will be informing industry strategies to improve productivity, including breeding for growth and quality.
- A phenotyping platform has been used to identify outstanding individual trees for at least one key trait with superior germplasm and is being deployed by 2016.
- By 2016 at least two new biotech trees are evaluated for traits (e.g., productivity and herbicide resistance) and reported to stakeholders.
- By 2018 Scion will have developed a systems model of the current forest products value chain to determine where to intervene in order to maximise benefits from the existing forest resource. This will have created better connectivity between growers and processors, and better connectivity between small-scale forest growers.
- By 2019 at least two major forest growers have changed their management practices and are applying new treatments designed to increase productivity of mid-rotation stands.
- On-going: the Forestry Library, Permanent Sample Plots (National Forest Tree Database), and Tree Genetic Archives remain viable and provide valuable information about the national forestry position for New Zealand.

**Our key partners in delivery are:** the New Zealand forest growers operating through the Forest Growers Levy Trust Board Inc., The New Zealand Forest Owners Association, New Zealand Farm Forestry Association and Māori operating through their forestry groups; supported by research and technical partnerships with the Radiata Pine Breeding Company Ltd, ArborGen, Forest Genetics Ltd and Landcare

Research. The main government agency involved is the Ministry for Primary Industries.

**Technology transfer:** Scion will continue to work in partnership with industry. This includes jointly developing plans, project methodology, exemplars and together implementing the outcomes. An important technology transfer tool is the Forecaster™ DSS, used by most of the forest growers, in which we will embed the new technical outcomes.

### Investment



Commercial \$5.0, Core funding \$2.8, MBIE direct \$3.4, MBIE indirect \$0.1, Other Government \$0.1. Total \$11.4 (millions).

**Alignment to National Science Challenges:** \$100,000 aligned to Science for Technological Innovation.

**Databases and Collections:** National Forest Library, National Forest Tree Database (PSP) and Tree Genetic Archives are supported to the value of \$1.65 million of which \$50,000 is from Core Funding.

## Impact KPI-2: Extract value from forests and dispersed forest holdings

By 2019 tools developed by Scion and its partners will be used by New Zealand forest growers and harvesting companies to reduce harvesting costs, improve safety of tree extraction and improve supply chain logistics, leading to growth in regional tree planting. Leading indicators are:

- Prototypes of new harvesting and supply chain tools have been demonstrated by 2016 that have the potential

<sup>49</sup> John Moore personal communication, May 2014: Forecaster scenario analysis.

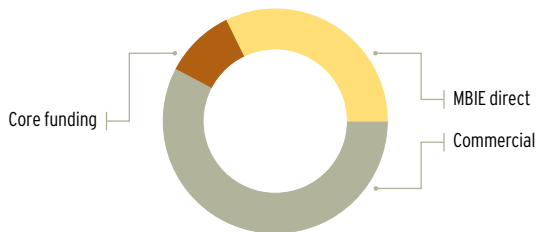
to save the forestry industry at least \$50 million per annum over 2010 costs.

- Remote sensing technologies are being used by forest growers to obtain quantitative information on the performance of their forests and which is being used to inform management practices.
- Supported at least one iwi owned forest and land holding cluster to realise at least a 20% increase in returns from their land over 2014 values by 2016.

**Our key partners in delivery are:** The New Zealand forest growers operating through the Forest Growers Levy Trust Board Inc., The New Zealand Forest Owners Association, New Zealand Farm Forestry Association and Māori operating through their forestry groups. Research and technical partnerships with the FOA R&D Committee and Universities of Canterbury and Auckland. The main government agency involved is the Ministry for Primary Industries.

**Technology transfer:** Scion will continue to work in partnership with industry and iwi. This includes jointly developing plans, project methodology and prototypes and together implementing the outcomes. We will continue to work with our commercialisation partners to refine harvesting tools (such as CHIPS) and similar to facilitate uptake of research outcomes.

#### Investment



Commercial \$1.8, Core funding \$0.3, MBIE direct \$1.0, MBIE indirect \$0, Other Government \$0. Total \$3.1 (millions).

### Impact KPI-3: Quantify the role of forests in increasing economic, environmental and social outcomes for New Zealand

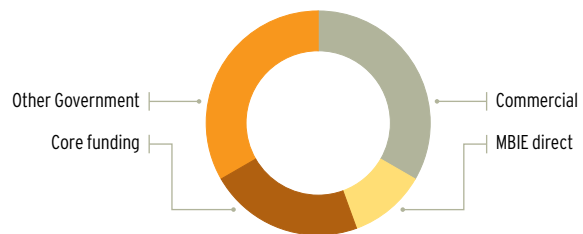
By 2019 Scion and its partners will have compellingly demonstrated to key stakeholders (e.g., Māori, regional councils and policy makers) the role of forests in creating resilient landscapes through forest contributions to regional economies and provision of ecosystem services. Leading indicators of this are:

- By 2016 at least one business case for expansion of new forests onto un-developed land will have been developed by Scion with a regional authority and/or an iwi.
- By 2017 key stakeholders will be using Scion's evidence-based information that quantifies forests' economic and natural capital contributions to New Zealand's growth, regional development and environmental performance strategies.
- By 2019 Scion's information will have contributed to New Zealand's national and international reporting obligations and the New Zealand Freshwater National Objectives Framework.

Our key partners in delivery are: the New Zealand forest growers operating through the Forest Growers Levy Trust Board Inc., The New Zealand Forest Owners Association, New Zealand Farm Forestry Association and Māori operating through their forestry and land holding entities, Tane's Tree Trust, the Northern Totara Working group and local and regional authorities and Department of Conservation (as a land owner). Supporting delivery of the above will be our research and technical partnership with Landcare Research. The main government agencies involved with the above are the Ministry for Primary Industries, Ministry for the Environment and Department of Conservation.

**Technology transfer:** Scion will work in partnership with the key stakeholders including iwi, regional councils and New Zealand Farm Forestry Association to develop business cases and exemplars. Key tools that will be used and continue to be developed with these stakeholders include MyLand, Forest Investment Finder and other tree and land use calculators.

#### Investment



Commercial \$0.3, Core funding, \$0.2, MBIE direct \$0.1, MBIE indirect \$0, Other Government \$0.3. Total \$0.9 (millions)

**Alignment to National Science Challenges:** \$145,000 of Core funding aligned to Our Land and Water.

### IO2: Increase the profitability of solid wood processing through customer solutions and supply chain innovations

By 2026, Scion has supported the industry in achieving 6% year-on-year growth in the export of wood products to an estimated target value of at least \$6 billion per annum.

We will support the industry and key stakeholders in:

- Achieving operational efficiencies to enhance international competitiveness through application of wood segregation technologies.
- Develop new and enhanced engineered wood products to support export growth into high-value niche markets.
- Increase exports of wood products, based on Douglas-fir, eucalypts, cypresses and indigenous timbers, into high-value niche applications.
- Increase the application of wood and wood-based products in building solutions to deliver greater economic, social and environmental outcomes.

**Alignment to the National Science Challenges.** Science for technological innovation - increasing use of robotic technologies and 'big data' for productivity gains along the value chain. This outcome would also be linked to the potential initiative in *Building better homes, towns and cities*.



## Impact KPI-4: New seed-to-market value chains for specialty wood products

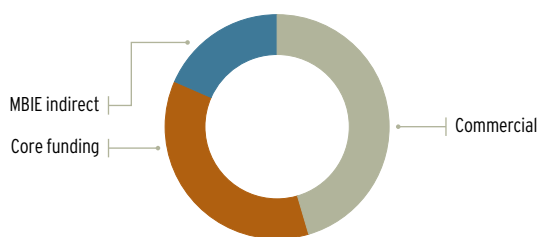
By 2019 Scion and its partners will have provided tools, new product options and plant material that will have supported the aspirations of growers and manufacturers to invest in new manufacturing facilities and expand plantings of Douglas-fir, eucalypts, cypresses and indigenous species based on increased confidence of securing highest possible value for their products along the entire seed-to-market value chain. Leading indicators of this are:

- By 2016 Scion's technical outcomes will have input into the development of at least one market ready product from Douglas-fir or a eucalypt capable for uptake in an international market.
- By 2016 Scion and our partners will have identified the economic opportunity for utilisation of some indigenous species, and have external investment supporting realisation of the commercial opportunity associated with those species. Particular focus will be given to support the economic and social development of Northland, East Coast/Hawkes Bay and Central North Island.
- By 2019 Scion will have provided tools, new plant material (e.g., germplasm) and technologies along the seed-to-market value chain that will increase the confidence of growers of Douglas-fir, eucalypts and cypresses to increase plantings of these species by at least 5% over 2014 plantings.

**Our key partners in delivery are:** The New Zealand forest growers operating through the Forest Growers Levy Trust Board Inc., The New Zealand Forest Owners Association, New Zealand Farm Forestry Association and Māori operating through their forestry and land holding entities, Tane's Tree Trust, the Northern Totara Working group, local and regional authorities and their economic development agencies, Ministry for Primary Industries, Department of Conservation, Landcare Research and the University of Canterbury.

**Technology transfer:** Scion will work in partnership with the key stakeholders including iwi, regional councils and forestry and wood manufacturing companies to build business cases and exemplars to enable all parties to make the most informed decisions as to taking the programme forward. Other key tools that will be used include Forest Investment Finder and tree growth calculators such as the kauri growth calculator.

### Investment



Commercial \$0.5, Core funding \$0.4, MBIE direct \$0, MBIE indirect \$0.2, Other Government \$0. Total \$1.1 (millions).

## Impact KPI-5: Expand opportunities for wood products and systems

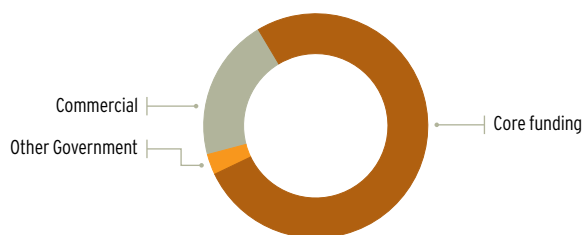
By 2019 Scion will have supported wood processing and manufacturing companies by delivering new productivity enhancing tools and technologies that assist them to meet their growth targets and encourage increased investment in wood-based manufacturing in New Zealand. Leading indicators of this are:

- By 2015 Scion will have demonstrated the potential to maximise recoverable yield, minimise waste, and manage variability between and within radiata pine logs.
- By 2015 Scion will have demonstrated and secured external investment to enable at least one new engineered wood product with demonstrated potential to compete in high margin market segments.
- By 2016 Scion will have demonstrated to a pre-commercial stage at least one new wood preservation/protection system that meets the needs and ability to support New Zealand wood products in New Zealand's most environmentally discerning markets.
- By 2019 the Woodscape methodologies have been adopted and underpinned, at least to business case stage, the development of a new or substantially enhanced wood manufacturing operation.

**Our key partners in delivery are:** The New Zealand Wood Processing and Manufacturing Association and their members and affiliated groups, Solid Wood Innovation, Standards New Zealand, Falcon Engineering, Ministry for Primary Industries, Windsor Engineering Ltd, Abodo, FP Innovations, Furniture Association of New Zealand, Wurzburg, Gottingen and EU COST Actions.

**Technology transfer:** Scion will work in partnership with the key stakeholders in co-developing project plans and implementation strategies. In product development Scion will develop exemplars including piloting of processes and products with industry partners.

### Investment



Commercial \$0.7, Core funding \$2.6, MBIE direct \$0, MBIE indirect \$0, Other Government \$0.1. Total \$3.4 (millions).

## Impact KPI-6: Cost effective and resilient buildings using New Zealand wood-based materials

By 2019 Scion product solutions will be embedded in new constructions to support the New Zealand wood products industry to increase the use of wood and wood-based products in residential and light-commercial applications

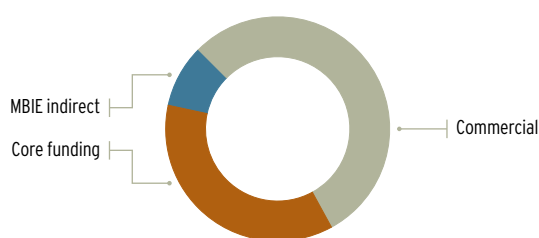
and help grow their projected revenues to an additional \$115 million per annum by 2022 through exploitation of off-site building processes. Leading indicators of this are:

- By 2016 Scion, with industry, will have developed new systems that can be incorporated into New Zealand buildings, improving affordability and/or building performance.
- By 2019 Scion's new innovations in wood-based building products will be embedded in new industry building innovations for domestic and export applications.
- Ongoing - supported the industry and Government in developing standards to enable greater uptake of wood products in the New Zealand building sector.

**Our key partners in delivery are:** The New Zealand Wood Processing and Manufacturing Association their members and their affiliated groups, the New Zealand Wood Council (Woodco); Building Research Association of New Zealand, Abodo, Ministry of Business, Innovation and Employment (Building and Housing) and Auckland University of Technology.

**Technology transfer:** Scion will work in partnership with the key stakeholders in co-developing project plans and implementation strategies. In product development Scion will develop exemplars including piloting of processes and products in conjunction with industry partners.

#### Investment



Commercial \$0.6, Core funding \$0.4, MBIE direct \$0, MBIE indirect \$0.1, Other Government \$0. Total \$1.1 (millions).

### IO3: Expand opportunities in the wood fibre, pulp, biopolymer, packaging and biochemical industries

By 2026 Scion has supported existing industries and new industries to establish new bio-based manufacturing capacity for export and domestic markets worth at least \$1 billion per annum more than 2011 values.

Our approach will be to support the New Zealand wood processing and manufacturing industries and those with aspirations to build new such enterprises that:

- Enable the New Zealand packaging industry to continue to grow through providing world leading packaging systems in the face of increasing regulatory, performance and consumer pressures on both the packaging and the produce they contain. (This also supports the important food exporting industries in New Zealand.)
- Increase the value of co-products in wood manufacturing operations (such as residues) to expand their product offerings, build new manufacturing enterprises and improve competitiveness of established industries.

- Create new product options based on plant materials to underpin the development of emerging or new materials-based manufacturing industries in New Zealand.
- Enable New Zealand to capture value from the burgeoning global market for green products.

#### Alignment to the National Science Challenges:

- Science for technological innovation - developing high performance new materials manufacturing and design capability.

### Impact KPI-7: Develop new wood and fibre-based manufacturing industries in New Zealand

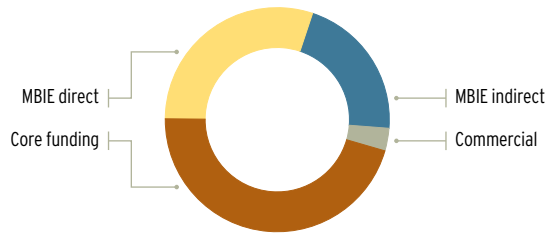
By 2019 new capital investment will be occurring in new manufacturing industries in New Zealand as Scion's developments in new high-value products derived from forest materials are being adopted. Leading indicators of this are:

- By 2014 at least one manufacturer will be commercially evaluating a new packaging application developed by Scion and Scion's partners.
- By 2015 Scion will have assisted at least one industry partner in producing transport fuels from woody biomass to develop a business case to enable informed decision for their further investment.
- By 2016 Scion will have developed to prototype stage at least one new high value co-product arising from wood processing that has been reviewed by a commercial partner for potential investment.
- By 2018 at least six new extruded products with renewable content have been developed to prototype stage and by 2019 at least two of these are incorporated in new product offerings by firms.
- By 2019 new high performance composites developed by Scion are supporting the development of new industries in New Zealand and providing direct revenue to New Zealand.

**Our key partners in delivery are:** the New Zealand Wood Processing and Manufacturing Association their members and their affiliated groups, Biopolymer Network Ltd, Packaging Council of New Zealand, Alto, Sonae Industria Ltd, Clariant New Zealand Ltd, ZESPRI Ltd, Altex, VITO, Momenive, PacNZ, PlasticsNZ, Innventia, Revolution Fibre Ltd, Finewood, Lignotech, EU COST Actions, OpenBio, Plant and Food Research, JBEI, Advanced Biofuels Network, National Renewable Energy Laboratory, AgResearch and the Universities of Waikato, Canterbury, Auckland, Victoria and Massey.

**Technology transfer:** Scion has in place industry advisory groups to guide programme direction and several companies working within the market to ensure market pull for all new products. In product development Scion will provide exemplars including piloting of processes and products in conjunction with industry.

**Investment**



Commercial \$0.3, Core funding \$4.5, MBIE direct \$2.9, MBIE indirect \$2.1, Other Government \$0. Total \$9.8 (millions).

**Alignment to National Science Challenges:** \$400,000 of Core funding aligned to Science for Technological Innovation NSC.

**IO4: Increase New Zealand’s energy security through the use of forest biomass, clean technologies and industrial symbiosis**

By 2026 bioenergy’s contribution to New Zealand’s primary energy supply has increased to 9% (an increase of 24PJ over 2010 values), including 350 million litres of liquid biofuels.

In addition to the strategies described above, this Outcome also aligns to the New Zealand Government Energy Strategy ([www.med.govt.nz/energy-strategy](http://www.med.govt.nz/energy-strategy)) and the Bioenergy Association of New Zealand aspiration to supply more than 25% of New Zealand’s energy needs and 30% of the country’s transport fuels from processing wood-crops and converting organic by-products to energy by 2040 ([www.banz.org.nz](http://www.banz.org.nz)). Our approach will be to:

- Support New Zealand industries, in particular wood fibre manufacturing operations, as they seek to increase use of bioenergy to 30% by 2022 equating to 270MW of new thermal bioenergy and 30MW of new electricity. Support the New Zealand wood processing industry to develop liquid biofuels to enhance their product offerings and increase the value extracted from processing residues.
- Support forest and land owners to explore options for using forests as an energy product or co-product.
- Support energy companies as they work to increase the renewable content of their energy products.
- Support the development of industries working in a symbiotic way, to develop mixes of products including energy and optimise use of other energy resources (e.g. geothermal energy) to create lowest embodied energy use per unit product) and greatest individual and collective value. This will directly support strengthening regional growth.

**Alignment to the National Science Challenges:**

- Science for technological innovation - developing high performance new materials manufacturing and design capability.

**Impact KPI-8: Diversify the products of existing firms in wood processing, pulp and fibre production in New Zealand**

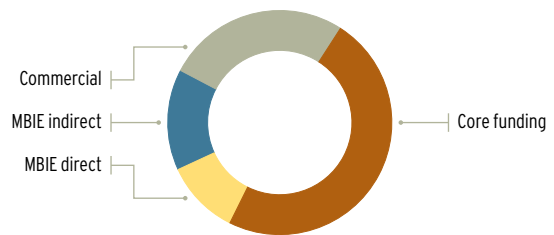
By 2019 Scion’s product and process developments will be embedded in existing wood processing industries to support them build greater economic and environmental resilience through diversification of their product offerings and reduced environmental impact. Leading indicators of this are:

- By 2015 Scion will have delivered at least one commercial solution to a firm or waste material treatment entity for the conversion of liquid or solid rich organic wastes into recoverable products to maintain BATEA (Best Available Technology Economically Achievable).
- By 2016 Scion will have supported the pulp industry in evaluating at least one new high-value co-product from their operations.
- By 2018 Scion will have supported a group of firms in one region to develop a value proposition, based on industrial symbiosis, outlining the benefits/risks across economic, social and environmental criteria, enabling them to make an informed decision for action.

**Our key partners in delivery are:** the New Zealand Wood Processing and Manufacturing Association and their members and affiliated groups, CHH Pulp and Paper, Norske Skog, Regional Councils, Industrial Symbiosis Kawerau, Bay of Connections, JBEI, Advanced Biofuels Network, National Renewable Energy Laboratory and the Universities of Waikato, Canterbury, Auckland, Victoria and Massey.

**Technology transfer:** Scion will continue to work in formal partnerships (e.g., Industrial Symbiosis Kawerau) to ensure approaches and methodologies employed are aligned to the needs of firms and their regions including iwi and implementation is maximised.

**Investment**



Commercial \$1.9, Core funding \$3.5, MBIE direct \$0.8 MBIE indirect \$1.1, Other Government \$0. Total \$7.3 (millions).

**IO5: Protect and enhance market access and improve risk management in the forest industry including for forest health and preparedness for biosecurity incursions, fire and climate change**

By 2026 ensure forest growing and wood product companies can meet their export revenue targets and increase their forest value by minimising risks associated with pests (insects, pathogens, weeds) that are either established,

biosecurity incursions, or that present market access issues, and climatic factors such as fire and wind and the frequency of extreme events.

Our approach will be to support the New Zealand forestry industry, Ministry for Primary Industries, Ministry for the Environment, Department of Conservation, land owners, rural authorities, regional councils, Māori, rural fire authorities and other key stakeholders to:

- Reduce the likelihood of new pest incursions and increase the effectiveness of pest eradication programmes.
- Reduce the impact of established pests with a particular emphasis on foliage diseases.
- Reduce impacts of rural fire on forests, communities and infrastructure through risk reduction, readiness, response and recovery approaches.
- Improve resilience to climate change and extreme weather events.
- Sustain nationally important technical capability in biosecurity and fire, and nationally significant collections relating to forest plants, insects, and fungi.

#### Alignment to the National Science Challenges:

- New Zealand's biological heritage - reducing the potential for pest incursion and increasing New Zealand's ability to respond to biosecurity issues.
- Resilience to nature's challenges - improving New Zealand's ability to reduce the impact of fire.

## Impact KPI-9: Ensure New Zealand forests are resilient to current and future natural threats

By 2019 new tools and technologies will have been developed to quantify and mitigate impacts from the increasing risk to New Zealand's forests from pests, fire and wind, and climate change, and will have been adopted by forest industries, land owners, and central and regional government. Leading indicators of Scion's progress are:

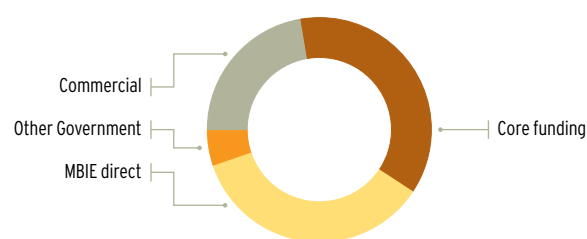
- By 2016 Ministry for Primary Industries will have adopted a new tool or method developed by Scion and Scion's research partners to enable early detection and/or eradication of a pest to New Zealand's forests.
- By 2016 Scion will have identified radiata pine germplasm with improved resistance to at least one foliar disease.
- By 2016 rural fire stakeholders through the Rural Fire Research Advisory Committee will have adopted new fire behaviour models or adopted enhanced data collection systems that lead to both enhanced fire fighter safety and intelligence for fire fighting decision making.
- By 2017 there will be at least two examples of policy makers or forest growers using Scion's models and tools to quantify and mitigate the impacts of climate change or severe weather.
- By 2018 options to reduce the impact of *Phytophthora* on radiata pine, kauri and one horticultural species have been identified.

- On-going: the National Forest Herbarium and the Forest Health Collections and Databases remain viable and provide valuable information on the national forestry position for New Zealand.

**Our key partners in delivery are:** the forestry industry operating through the Forest Growers Levy Trust Board Inc., forestry companies, Forest Owners Association (FOA), New Zealand Farm Forestry Association (FFA), regional and local councils, Māori groups, land owners, Ministry for Primary Industries, Department of Conservation, Ministry for the Environment, Ministry of Foreign Affairs and Trade, port authorities, Wood processors, New Zealand Fire Service Commission, New Zealand Defence Force, New Zealand Rural Fire Authorities, Rural Fire Research Advisory Committee (RFRAC), AgResearch, Landcare Research, Plant and Food Research, University of Canterbury, and Lincoln Bioprotection Centre.

**Technology transfer** will be achieved through Scion's close working relationship that Scion has with the above associations, government entities and industries. Scion will continue as part of the above teams (e.g., RFRAC, FOA) to jointly develop the annual work plans and ensure effective implementation.

#### Investment



Commercial \$1.7, Core funding \$2.8, MBIE direct \$2.7, MBIE indirect \$0, Other Government \$0.4. Total \$7.6 (millions).

**Alignment to National Science Challenges:** \$130,000 aligned to Resilience to Nature's Challenges and \$699,699 to New Zealand's Biological Heritage NSC.

**Databases and Collections:** National Forest Herbarium and National Forest Health Collections and Database are supported to the value of \$835,000 of which \$335,000 is from core funding.

## IO6: Ensure the forest industry's licence to operate (and reputation) through workers' safety and capabilities, verifiable environmental performance, product traceability and modern standards; and, by anticipating long-term change

Scion, through provision of tools, technologies and regulatory compliance frameworks, will support the New Zealand forest industry in addressing freedom to operate issues and thereby ensure access to international markets.



## Impact KPI-10: Sustain the New Zealand forest and wood product industry's licence to operate

This is an underpinning group of activities with broad impact across the forestry and forest products (and related) sectors. To ensure that effective progress is made against this Intermediate Outcome the following Impact KPI essentially summarises the activities that will be undertaken. Progress against these objectives will be reported as a narrative.

**Impact KPI:** By 2019 Scion has supported the industry to enhance its licence to operate. Leading indicators of this are:

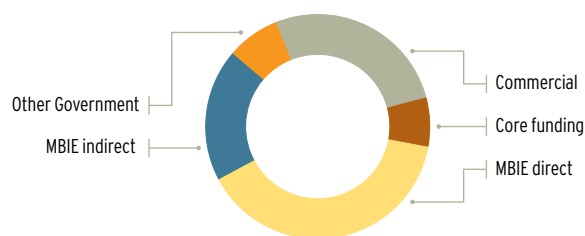
- By 2015 Scion and the forestry industry will have identified those specific activities where Scion can assist the industry in meeting its targets for improving worker safety.
- By 2016 Scion with its research and industry partners, defined a strategy to reduce the use of phytosanitary treatments, specifically methyl bromide, by at least 30%, and this will be presented to the Ministry for Primary Industries for evaluation and subsequent adoption by industry.
- By 2016 the benefits and risks of genetic modification research will have been quantified and presented to the forest industry, government and other key stakeholders for an informed decision on its future.
- By 2016 Scion will have (i) supported forest industries to maintain access to cost effective herbicides and management options for the environmental certification of New Zealand's forests, and (ii) agreed with stakeholders' research priorities for reducing wilding conifer impacts.

- On-going - support the New Zealand export industry by developing new options for products such as packaging to enhance acceptance of New Zealand products in international markets.

**Our key partners in delivery are:** the forest industry operating through the Forest Growers Levy Trust Board Inc., the Forest Owners Association, special stakeholder focus groups such as Stakeholders In Methyl Bromide Reduction, Ministry for Primary Industries, Ministry of Foreign Affairs and Trade, port authorities, Wood Processors and Manufacturers Association, Plant and Food Research and Biopolymer Network Ltd.

**Technology transfer** will be achieved through the close working relationship that Scion has with the above associations, government entities and industries. Scion will continue as part of the above teams (e.g., STIMBR, FOA, WPMA, New Zealand Packaging Council) to jointly develop the annual work plans and ensure effective implementation.

### Investment



Commercial \$0.9, Core funding \$0.2, MBIE direct \$1.3 MBIE indirect \$0.6, Other Government \$0.3. Total \$3.3 (millions).

# 6. Scion's supporting strategy

In this section, other elements of Scion's strategy (Figure 3, page 17) are presented to support the achievement of SCI targets.

## Develop a customer-focussed and high-performance culture

Scion's "People, Performance and Culture (PPC) Plan 2011-16" outlines the people and cultural requirements necessary for Scion to achieve its Statement of Core Purpose. Each year objectives are set to achieve the following outcomes:

- Build a high performance culture aligned to Scion's values.
- Develop organisational leadership and capability through workforce planning and tailored learning and development programmes.
- Attract, recruit and retain top talent.
- Ensure workplace safety and legislative compliance.
- Develop Scion's tikanga and capacity to engage effectively with Māori.
- Align remuneration and reward to the achievement of the Key Performance Indicators.
- Implement systems and administration support to achieve organisational efficiency and consistency in people management.

Over the SCI planning period Scion intends to:

1. Fully embed a health and safety culture and ensure Scion is at best practice with respect to health and safety.
2. Undertake more intensive workforce planning using tools adapted from the pan-CRI HR Managers' group to ensure Scion has the capabilities it requires for the future and that this takes into account capabilities held by other CRIs and coordinated through the National Science Challenges.
3. Build depth in leadership succession and organisational resilience, particularly at Level 4 (e.g., research leaders), by extending Scion's leadership development programme.
4. Increase the number of short-term visitors and sabbaticals to host international experts in fields of high importance to Scion's success; and grow the number of post-graduate students working on Scion initiated topics through its collaborations with New Zealand universities.

## Grow productivity through smart processes and systems

A comprehensive plan is in place to enhance Scion's facilities, Information Technology (IT) systems and equipment as follows:

**Facilities:** A 10-year infrastructure development plan, comprehensively reviewed and updated in 2012, is designed

to bring laboratory, office facilities and IT up to the standards required for a twenty-first century research organisation, addressing deferred maintenance and building new plant and equipment to enhance the uptake of Scion's technologies. This process will involve the modernisation and refurbishment of laboratory, office facilities and infrastructure and development of containment facilities consistent with the Environmental Protection Agency specifications to support extension of biological material development and enhancement.

Over the SCI planning period Scion plans to:

1. Undertake a major rebuild-refurbishment of its Timber Engineering Laboratory (estimated CAPEX is \$5-6 million).
2. Design and build an Innovation Centre Building (see page 20).
3. Complete office refurbishments.
4. Ensure all facilities and laboratories continue to comply with health and safety 'best practice' requirements.

**Systems:** IT-based financial and human resource management systems and application of IT systems to improve data management and local, national and international collaboration are critical to Scion's future success. Scion works closely with other CRIs to adapt best ideas and ensure IT systems are 'fit for purpose', are affordable over the long-term and take account of the very rapid innovation occurring in this sector.

Over the SCI planning period Scion intends to:

1. Develop capabilities and infrastructure to enable exploitation of 'big data' and improve access and reuse of data held in national collections by Scion (L&G8).
2. Enhance technology and knowledge transfer through effective information management, web delivery technologies and science data management planning. This supports Scion's strategy to grow productivity through smart processes and systems (L&G2).
3. Provide collaboration tools (such as enhanced video conferencing and SharePoint) to enable Scion to foster national and international science collaborations.
4. Increase pan-sector or pan-CRI collaboration or shared services opportunities.

**Science equipment:** Scion's plan is to purchase equipment that enables core science to be undertaken efficiently and to a high standard; and in niche areas, to provide competitive advantage (e.g., testing equipment for biomaterials product development). This is complemented by a plan to install pilot scale infrastructure to support market assessment and de-risk commercialisation of technologies arising from Scion's programmes. In particular, construction of bio-refinery pilot plant facilities to support Intermediate Outcomes/Impacts 3 and 4 is of high importance over the planning period. Scion will be seeking industry co-investment in the plant as part of its plan to support the scale-up of technologies for industry adoption.

Over the SCI planning period Scion plans to:

1. Continue its programme to develop pilot plant infrastructure to scale-up and de-risk the commercialisation of Scion (and partners') technologies.
2. Purchase equipment to support research into bio-oil production, disc scanning to understand the drivers of

improved wood quality, and improved storage for science materials.

Final allocation of CAPEX and re-investment of surpluses is subject to Board approval of the final business cases for each initiative.

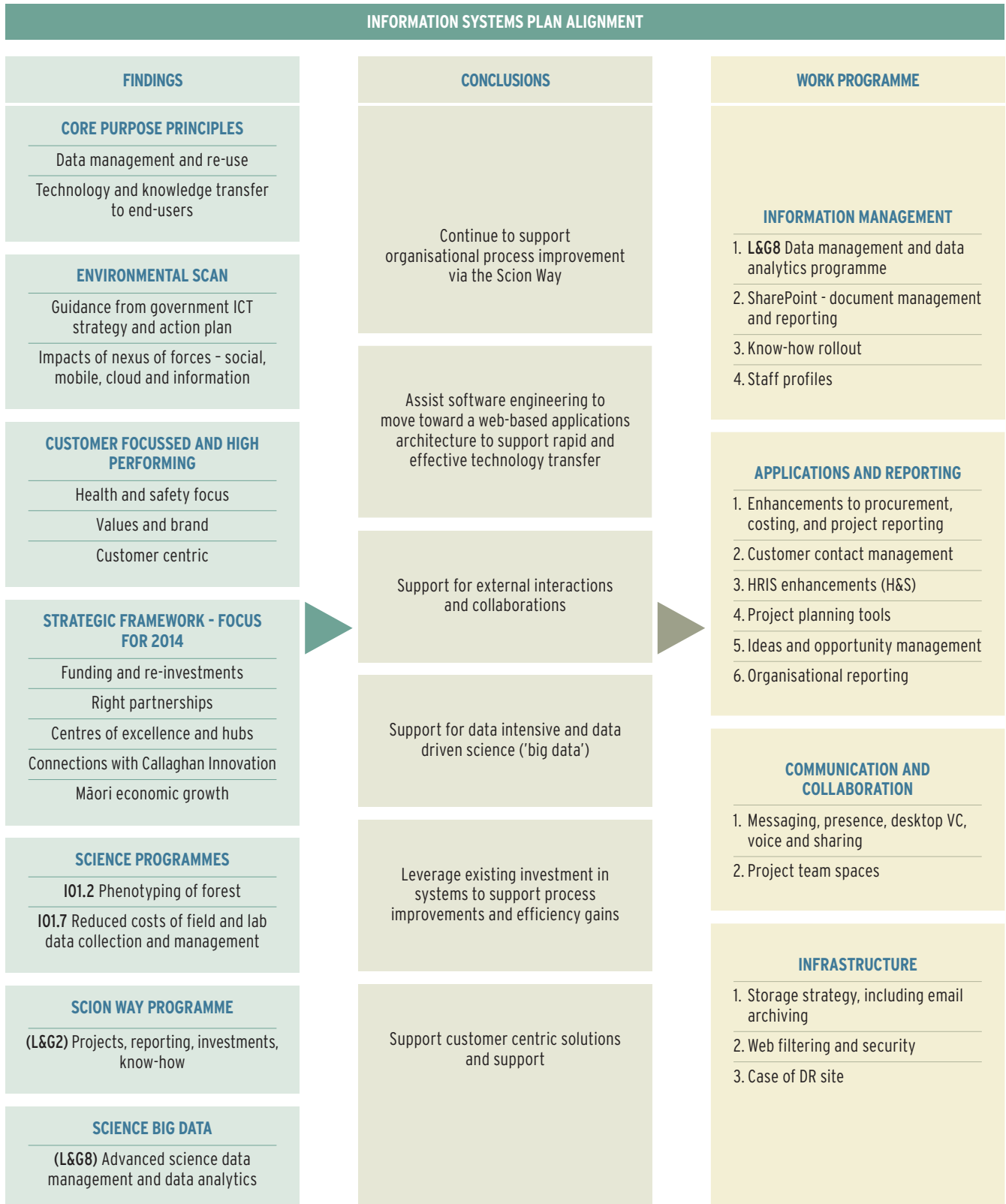


Figure 14: Scion's IT plan is aligned to achieve Core Purpose Outcomes and SCI targets.

## Improve knowledge and technology translation<sup>50</sup>

Technology translation at Scion occurs through a wide range of channels and mechanisms including: secondments of staff into firms (and vice versa); workshops and development of training material; visitor programmes to Scion and companies; Scion’s website; multi-media tools; media releases, trade articles, Scion’s newsletter *Scion Connections* and software decision support tools.

To further improve technology translation, Scion plans to:

1. Work with sector ‘change’ champions and adapt ‘best practice’ from other industries, such as the dairy industry and international thought leaders such as VTT (L&G5).
2. Apply techno-economic models to ensure all technologies optimally align with user needs and enable best packaging of technology for end-users.

3. Upgrade Scion’s website and *Scion Connections* newsletter; and, for iwi ‘put more tangible products in their hands’ and utilise established communication channels within Māoridom.
4. Use its ‘big data’ Learning and Growth (L&G) initiative (L&G8) to improve the sharing, analysis and interpretation of very large data sets.

## Collaborations to form best research teams

Scion collaborates extensively nationally and internationally to form the best possible teams to deliver its science and innovation outcomes. Scion has established a wide array of relationships and collaborations with universities, CRIs and international research entities. Examples are shown in Table 4. Of particular significance over the planning period will be the formation of a host of new relationships through the National Science Challenges.

EXAMPLES OF SCION PARTNERSHIPS DOMESTICALLY AND INTERNATIONALLY		
RELATIONSHIP	PARTIES INVOLVED	FOCUS AREAS
Materials Accelerator	Universities of Auckland and Waikato, Callaghan Innovation, Scion, MBIE	New bio-based composite materials and products from this
Sustainable Land Use Alliance (SLUA)	AgResearch, Plant & Food Research (PFR), Landcare Research; Scion	Sustainable land-use and management
Better Border Biosecurity (B3)	AgResearch, PFR, Landcare Research; Scion, MBIE	Primary industry pre- and post-border biosecurity
Bioresource Processing Alliance (BPA)	AgResearch, Callaghan Innovation, PFR, Scion, universities, MBIE	Bioprocessing technology for new products, process efficiency gains, and waste re-use and reduction
Canterbury University	School of Forestry, other faculty	Forest biosecurity, silviculture, mechatronics
Waikato University	Bay of Plenty Tertiary partnership	Postgraduate programmes, executive education
Massey University	School of Design, College of Science	Industrial design and packaging technologies (including with new materials)
VTT (Finland)	VTT (Australia)	Forest industry and new bioeconomy science and technology solutions
Forest Product Innovation (Canada)	NZ Wood Council	Forest industry revitalisation, value chain synthesis and new technologies
Korean Institute for Bioenergy Research (KIER)	NZTE	Thermochemical technologies for wood-to-biofuels)

Table 4: *Examples of Scion partnerships domestically and internationally.*

<sup>50</sup> The term ‘technology translation’ (rather than transfer) explicitly acknowledges the importance of user engagement in the process of introducing new knowledge, technologies and practices that enable change in individuals, communities or industries.

Scion plans to:

1. Work closely with the teams in the National Science Challenges and ensure these function efficiently, are well-supported by project management tools and reporting systems (i.e., the Scion Way) and NSC milestones are met on schedule.
2. Continue to nurture the alliances and relationships shown in Table 4, while seeking ways to improve their operational efficiency.
3. Support the growth of the entities in which it is a shareholder such as the Biopolymer Network Ltd<sup>51</sup> (Scion owns a third), which has an exciting pipeline of technologies coming through to market realisation,

including Zealafoam™ a light weight, compostable product for fresh food packaging.

4. Develop its international network (as described earlier) through the L&G5 reinvestment initiative. Agencies with world leading capability and technologies that are synergistic and complementary to Scion, such as VTT (Finland), Forest Products Innovation (Canada) and Forest Wood Products (Australia) will be a priority in this endeavour.

## Improve accessibility to Scion's databases and collections

Scion has stewardship of the following resources of national significance:

### SCION'S DATABASES AND COLLECTIONS OF NATIONAL SIGNIFICANCE

DATABASE/COLLECTION	DESCRIPTION
<b>National Forest Herbarium and Database</b>	This nationally significant database and collection specialises in plants significant to plantation and indigenous forestry in New Zealand and includes a wide range of native and amenity species. This is the only database and collection held by Scion that was supported by the Research Infrastructure (Backbone) Investment Fund.
<b>National Forestry Library</b>	The National Forestry Library contains publications, in a variety of formats, relating to forestry and wood processing research over the last 75 years. It represents the collected published heritage of forestry and related industries in New Zealand.
<b>Permanent Sample Plot Database</b>	An internationally unique database of sites that are used to measure growth and development of plantation forest trees across New Zealand
<b>National Wood Performance Archive</b>	Over 70 years of records of wood durability and performance across four sites in New Zealand.
<b>National Forest Insect Collection</b>	An internationally registered collection of identified forest insects in New Zealand.
<b>National Forest Culture Collection</b>	An internationally registered living collection of fungi (and bacteria).
<b>National Forest Mycological Herbarium</b>	An internationally registered collection of dried specimens of fungi and plant material containing fungi.
<b>The Wood Fibre Refining Facility</b>	This is a small scale industrial facility capable of processing wood to produce fibre and pulp. It is used extensively to test operational scenarios for New Zealand's pulp and fibre production companies. It is the largest such test operation in the Southern Hemisphere.

These collections, databases and research assets will continue to be maintained to a high standard (as finances allow) enabling public access and re-use of the data. The annual cost of sustaining databases and collections is circa

\$1.3 million per annum, with \$400,000 of this provided through core funding. In addition, a plan is being implemented with robust cyber security to improve public access to and reuse of forestry data generated and/or held by Scion.

<sup>51</sup> See <http://www.biopolymernetwork.com> for background about the company and its bio-based solutions.



## Pan-CRI shared services

Scion participates in several pan-CRI initiatives intended to improve effectiveness of delivery on our core purpose and greater efficiency with consequent cost savings. Joint action, as well as benchmarking and implementation of best practice across participants, are key elements.

The pan-CRI procurement forum currently delivers measurable savings of \$3 million annually across its seven members. This forum complements the all-of-government

procurement reforms through which Scion is accessing IT, vehicle, energy and other savings. Scion also participates in the pan-CRI insurance collective.

Through the 'umbrella' coordination of ScienceNZ, all CRIs have now adopted the Snaphire software system as their standard tool for recruitment. Other outcomes from the CRI human resources group include consistency in career progression opportunities, job band descriptors and capability planning tools. A new initiative in leadership development is under consideration by ScienceNZ.

# 7. Financial performance and reinvestment

**1. Financial projections and performance:** Scion's updated financial projections through to June 2019 are summarised in Table 5. Financial performance indicators are described in Table 6. Associated consolidated cashflow and balance sheet details are presented Tables 8 and 9.

Scion is forecasting to grow revenues by 2.5% to \$49.034 million and achieve an Operating Profit (EBIT) of \$2.399 million (Table 5). This represents a 7.8% return

on equity (RoE) before reinvestment. Reinvestment of \$1.033 million will generate a tailored RoE of 5.6% (Table 6). Future revenues are projected to increase at 3.4% to 3.7% annually. Risks to achieving these financial targets are the unknown scale of contribution of National Science Challenges, ability to grow licensing revenues, ongoing fiscal constraints on Crown and local government expenditure.

## PROJECTED STATEMENT OF FINANCIAL PERFORMANCE FOR THE FIVE YEARS ENDING 30 JUNE 2019

	30/06/2014 \$000	30/06/2015 \$000	30/06/2016 \$000	30/06/2017 \$000	30/06/2018 \$000	30/06/2019 \$000
<b>REVENUE</b>						
Core Funding	17,733	17,733	17,773	17,733	17,733	17,733
Other Crown Revenue	9,704	12,291	12,891	13,504	14,128	14,766
Commercial and Other	20,402	19,010	20,128	21,256	22,573	23,963
<b>Total Revenue</b>	<b>47,839</b>	<b>49,034</b>	<b>51,752</b>	<b>52,493</b>	<b>54,434</b>	<b>56,462</b>
<b>OPERATING EXPENDITURE</b>						
Personnel	25,063	25,413	26,175	26,960	27,823	28,713
Other Operating Costs	18,889	20,089	20,769	21,561	22,384	23,277
<b>Total Operating Expenditure</b>	<b>43,952</b>	<b>45,502</b>	<b>46,944</b>	<b>48,521</b>	<b>50,207</b>	<b>51,990</b>
<b>SCION MARGIN</b>	<b>3,887</b>	<b>3,532</b>	<b>3,807</b>	<b>3,971</b>	<b>4,227</b>	<b>4,471</b>
Loss on disposal of Fixed Assets	(7)	0	0	0	0	0
Restructuring Costs	(501)	(100)	(100)	(100)	(100)	(100)
<b>EBIT-R*</b>	<b>3,379</b>	<b>3,432</b>	<b>3,707</b>	<b>3,871</b>	<b>4,127</b>	<b>4,371</b>
Reinvestment	(1,019)	(1,033)	(1,100)	(1,100)	(1,100)	(1,100)
<b>EBIT</b>	<b>2,360</b>	<b>2,399</b>	<b>2,656</b>	<b>2,771</b>	<b>3,027</b>	<b>3,271</b>
Net Interest Income/(Expense)	61	90	49	40	42	33
<b>Profit before tax</b>	<b>2,421</b>	<b>2,489</b>	<b>2,656</b>	<b>2,811</b>	<b>3,069</b>	<b>3,304</b>
Tax	(697)	(722)	(770)	(815)	(890)	(958)
<b>Group Profit after Tax</b>	<b>1,724</b>	<b>1,767</b>	<b>1,886</b>	<b>1,996</b>	<b>2,179</b>	<b>2,346</b>
Share of after tax profit from Associated Companies	(150)	0	0	0	0	0
<b>Profit attributable to Shareholders</b>	<b>1,574</b>	<b>1,767</b>	<b>1,886</b>	<b>1,996</b>	<b>2,179</b>	<b>2,346</b>

\*EBIT-R is EBIT before reinvestment

Table 5: Projected Statement of Financial Performance for the five years ending 30 June 2019.

	Forecast 2014	Target 2015	Target 2016	Target 2017	Target 2018	Target 2019
<b>EFFICIENCY:</b>						
Operating margin	11.9%	12.0%	12.4%	12.8%	13.2%	13.6%
Operating margin per FTE	\$18,368	\$19,275	\$20,556	\$21,771	\$23,152	\$24,637
<b>RISK:</b>						
Quick ratio	1.30:1	1.25:1	0.92:1	1.10:1	0.90:1	0.99:1
Interest coverage	N/A	N/A	N/A	N/A	N/A	N/A
Operating margin volatility	11.3%	12.6%	13.1%	8.8%	9.5%	10.6%
Forecasting risk	(1.4)%	0.7%	0.5%	0.2%	0%	0%
<b>GROWTH/INVESTMENT:</b>						
Before reinvestment	7.8%	7.8%	7.9%	7.8%	7.8%	7.8%
Adjusted return on equity	5.2%	5.6%	5.6%	5.6%	5.8%	5.9%
Revenue growth	5.4%	2.5%	3.5%	3.4%	3.7%	3.7%
Capital renewal	1.7x	1.5x	2.2x	1.1x	1.9x	1.4x

Table 6: Projected Financial Performance Indicators for the five years ended 30 June 2019.

**2. Reinvestment of surpluses:** Scion's reinvestment portfolio underpins its strategy through Learning and Growth (L&G) initiatives (see Figure 3, page 17). Business investment cases for each L&G are reviewed by the Board as part of the annual refreshing of Scion's strategy and SCL, and preparation of the Annual Operating Plan.

In the first two years after the CRI Taskforce reforms, these incorporated significant 'internal facing' investment to support leadership development and culture change, the design and adoption of systems and processes to improve organisational productivity (the Scion Way); catch-up on a backlog of building repairs and maintenance; and improving Scion's capability to engage effectively with Māori.

In 2014/15, with the exception of final year of smart systems and processes (L&G2), reinvestments are all external facing initiatives (see Table 7) that support Scion's strategy and forest industry stakeholders goals:

1. Accelerate commercialisation (L&G4);
2. International S&T Collaborations (L&G5);
3. Enhance technology translation through secondments and targeted training workshops (L&G6);
4. Grow the Māori economy through improved communication (L&G7); and
5. 'Big data' informatics capability (L&G8).

A brief rationale was provided earlier (pages 36-40) for these strategic initiatives. Levels of investment in each L&G and the aggregate impact on RoE are shown in Table 7. Thus, Scion will continue to operate within the guidelines of the CRI Balance Sheet review and retain flexibility to reduce expenditure if revenue growth is less than planned.

	2015		2016		2017		2018		2019	
	Profit	RoE	Profit	RoE	Profit	RoE	Profit	RoE	Profit	RoE
<b>REINVESTMENT PROJECT ('000)</b>										
L&G 1 - A customer focussed culture	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
L&G 2 - Productivity through smart systems	(173)	(0.5%)	0	0.0%	0	0.0%	0	0.0%	0	0.0%
L&G 3 - A safe modern workplace	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
L&G 4 - Accelerate commercialisation	(400)	(1.2%)	(450)	(1.3%)	(500)	(1.4%)	(500)	(1.3%)	(500)	(1.2%)
L&G 5 - International S&T collaborations	(80)	(0.2%)	(80)	(0.2%)	(80)	(0.2%)	(80)	(0.2%)	(80)	(0.2%)
L&G 6 - Enhance technology translation, secondments	(100)	(0.3%)	(100)	(0.3%)	(100)	(0.3%)	(100)	(0.3%)	(100)	(0.2%)
L&G 7 - Engage Māori, build Māori economy	(30)	(0.1%)	0	0.0%	0	0.0%	0	0.0%	0	0.0%
L&G 8 - Big data, industry informatics	(250)	(0.8%)	(250)	(0.7%)	(250)	(0.7%)	0	0.0%	0	0.0%
Future initiatives - Opex	0	0.0%	(220)	(0.6%)	(170)	(0.5%)	(420)	(1.1%)	(420)	(1.0%)
<b>Total reinvestment</b>	<b>(1,033)</b>	<b>(3.1%)</b>	<b>(1,100)</b>	<b>(3.2%)</b>	<b>(1,100)</b>	<b>(3.0%)</b>	<b>(1,100)</b>	<b>(2.8%)</b>	<b>(1,100)</b>	<b>(2.7%)</b>
Tax	289	0.9%	308	0.9%	308	0.8%	308	0.8%	308	0.8%
<b>Profit impact of reinvestment</b>	<b>(744)</b>	<b>(2.2%)</b>	<b>(792)</b>	<b>(2.3%)</b>	<b>(792)</b>	<b>(2.2%)</b>	<b>(792)</b>	<b>(2.0%)</b>	<b>(792)</b>	<b>(1.9%)</b>
<b>Initial target RoE</b>		<b>7.8%</b>		<b>7.9%</b>		<b>7.8%</b>		<b>7.8%</b>		<b>7.8%</b>
<b>Revised RoE target after impact of reinvestment</b>		<b>5.6%</b>		<b>5.6%</b>		<b>5.6%</b>		<b>5.8%</b>		<b>5.9%</b>

Table 7: Summary of strategic learning and growth (L&G) initiatives 2014/15 to 2018/19, underlying (target) RoE and tailored rate of return. Allocations from 2015/16 are indicative.

### 3. Cash position, balance sheet structure and dividends:

Scion is forecasting end-of-year cash balances in the range of \$0.3 million to \$2.5 million over the five year planning period (Table 8). This is judged to be prudent given the ongoing revenue uncertainty with MBIE core and contestable funding (Scion has a \$20 million exposure in FY2016); the yet to be determined impact of National Science Challenges; and proposed capital renewal programme (forecast at between 1.1X and 2.2X depreciation for the next five years) which includes essential pilot plant for technology scale-up and evaluation; and modernisation of the aging (circa 1950s) wood engineering laboratories and test facilities

(scheduled to commence in 2015/16). The combination of reinvestment of surpluses of \$1.0-1.1 million per annum and capital renewal (\$4.5-8.0 million per annum) means Scion net assets are forecast to grow by \$10.2 million to \$40.97 million over the planning period (Table 9). Scion anticipates recommencing dividend payments when the current external operating environment stabilises; MBIE investment exposure for FY2016 reduces (post the 2015 core funding review) and the large items in the 10-year campus renewal plan (initiated in 2011) are completed. This position will be reviewed annually and on current projections is likely to be 2016/17.

#### PROJECTED STATEMENT OF CONSOLIDATED CASHFLOWS FOR THE FIVE YEARS ENDED 30 JUNE 2019

	30/06/2014 \$000	30/06/2015 \$000	30/06/2016 \$000	30/06/2017 \$000	30/06/2018 \$000	30/06/2019 \$000
<b>CASHFLOW FROM OPERATING ACTIVITIES</b>						
<b>Cash received from operations</b>						
Crown	28,662	29,099	30,624	31,237	31,861	32,499
Other Clients	19,337	19,304	19,995	21,121	22,435	23,822
Interest	65	89	49	40	42	53
<b>Total Cash received from operations</b>	<b>48,064</b>	<b>48,491</b>	<b>50,668</b>	<b>52,397</b>	<b>54,338</b>	<b>56,354</b>
<b>Cash disbursed on operations</b>						
Personnel	25,618	25,335	26,176	26,958	27,818	28,705
Suppliers	15,910	17,238	17,988	18,529	19,125	19,738
Interest on debt	3	0	0	0	0	0
Taxation	862	539	642	800	865	936
<b>Total Cash disbursed on operations</b>	<b>42,393</b>	<b>43,112</b>	<b>44,806</b>	<b>46,288</b>	<b>47,808</b>	<b>49,379</b>
<b>Projected Net Cashflows from Operations</b>	<b>5,671</b>	<b>5,379</b>	<b>5,862</b>	<b>6,109</b>	<b>6,531</b>	<b>6,975</b>
<b>CASHFLOW FROM INVESTMENT ACTIVITIES</b>						
Sale of fixed assets	(150)	0	0	0	0	0
Purchase of fixed assets	(5,556)	(5,080)	(7,800)	(4,300)	(7,800)	(5,800)
Purchase of intangibles	(215)	(120)	(200)	(200)	(200)	(200)
<b>Net Cash Received/(Disbursed) from Investing Activities</b>	<b>(5,921)</b>	<b>(5,200)</b>	<b>(8,000)</b>	<b>(4,500)</b>	<b>(8,000)</b>	<b>(6,000)</b>
<b>CASHFLOW FROM FINANCING ACTIVITIES</b>						
Increase in term debt	0	0	0	0	0	0
Repayment of term debt	0	0	0	0	0	0
<b>Total Cash Disbursed on Financing Activities</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Net Increase (decrease) in cash</b>	<b>(250)</b>	<b>179</b>	<b>(2,138)</b>	<b>1,609</b>	<b>(1,469)</b>	<b>975</b>
Exchange Rate effect	0	0	0	0	0	0
Opening cash balance	2,538	2,289	2,468	330	1,939	470
<b>Closing Cash Balance</b>	<b>2,288</b>	<b>2,468</b>	<b>330</b>	<b>1,939</b>	<b>470</b>	<b>1,444</b>

Table 8: Projected Statement of Consolidated Cashflows for the five years ended 30 June 2019.

**PROJECTED STATEMENT OF CONSOLIDATED BALANCE SHEET FOR THE FIVE YEARS ENDED 30 JUNE 2019**

	30/06/2014	30/06/2015	30/06/2016	30/06/2017	30/06/2018	30/06/2019
	\$000	\$000	\$000	\$000	\$000	\$000
<b>CURRENT ASSETS</b>						
Short term investments and cash	2,289	2,468	330	1,939	470	1,444
Debtors	6,247	6,635	6,768	6,903	7,042	7,182
Prepayments	795	827	827	827	827	827
Inventory	176	150	150	150	150	150
<b>Total Current Assets</b>	<b>9,507</b>	<b>10,080</b>	<b>8,074</b>	<b>8,919</b>	<b>8,488</b>	<b>9,603</b>
<b>LESS CURRENT LIABILITIES</b>						
Creditors	3,427	3,859	4,052	4,255	4,468	4,691
Personnel liabilities	3,184	3,302	3,401	3,503	3,608	3,716
Income in advance	1,729	1,490	1,490	1,490	1,490	1,490
Provision for tax	(55)	128	257	272	297	319
<b>Total Current Liabilities</b>	<b>8,285</b>	<b>8,779</b>	<b>9,442</b>	<b>9,519</b>	<b>9,862</b>	<b>10,216</b>
<b>Net Working Capital</b>	<b>1,222</b>	<b>1,301</b>	<b>(1,125)</b>	<b>300</b>	<b>(1,374)</b>	<b>(613)</b>
<b>INVESTMENTS</b>						
Investments in subsidiaries & associates/ Intangible Assets	194	194	194	194	194	194
Intangible Assets	473	392	592	792	992	1,192
<b>Total Investments</b>	<b>667</b>	<b>586</b>	<b>786</b>	<b>986</b>	<b>1,186</b>	<b>1,386</b>
<b>FIXED ASSETS</b>						
Fixed Assets	31,850	33,680	37,792	38,163	41,816	43,201
Biological Assets	745	745	745	745	745	745
<b>Total Fixed Assets</b>	<b>32,595</b>	<b>34,425</b>	<b>38,537</b>	<b>38,908</b>	<b>42,561</b>	<b>43,946</b>
<b>TERM LIABILITIES</b>						
Provision for Staff Liabilities	1,597	1,657	1,657	1,657	1,657	1,657
Deferred tax liability	2,091	2,091	2,091	2,091	2,091	2,091
Term Debt	0	0	0	0	0	0
<b>Total Term Liabilities</b>	<b>3,688</b>	<b>3,748</b>	<b>3,748</b>	<b>3,748</b>	<b>3,748</b>	<b>3,748</b>
<b>Projected Total Net Assets</b>	<b>30,796</b>	<b>32,564</b>	<b>34,450</b>	<b>36,446</b>	<b>38,625</b>	<b>40,971</b>
<b>Represented by</b>						
Share Capital	17,516	17,516	17,516	17,516	17,516	17,516
Retained earnings brought forward	11,645	13,219	14,987	16,872	18,869	21,047
Revaluation Reserve	61	61	61	61	61	61
Current profit (loss)	1,574	1,767	1,886	1,996	2,179	2,346
<b>Projected Closing Shareholders Funds</b>	<b>30,796</b>	<b>32,564</b>	<b>34,450</b>	<b>36,446</b>	<b>38,625</b>	<b>40,971</b>

Table 9: *Projected Statement of Consolidated Balance Sheet for the five years ended 30 June 2019.*



# 8. Performance monitoring and reporting

Scion's strategic indicators, measures and targets are presented in Table 10. These comprise CRI generic and Scion specific indicators. Because some indicators constitute a 'bundle' of measures these will be traffic lighted (green, orange, red) and supported by qualitative (and as appropriate quantitative) information in Scion's quarterly Shareholder reports; and public six monthly and annual reports. The latter will incorporate financial reports

consistent with the accounting policies described in Appendix 4. Financial indicators reported quarterly are presented in Table 6 (Section 7).

Scion's internal Annual Operating Plan includes additional science output, health and safety; and social responsibility measures. Most of these measures have been tracked over at least five years and therefore provide insights into trends of organisational operational effectiveness and efficiency.

	INDICATOR NAME	MEASURE	FREQUENCY	2014	TARGET
CRI GENERIC INDICATORS	End user collaboration	Revenue per FTE (\$) from commercial sources	Quarterly	\$65,813	\$62,327
	Research collaboration	Number of peer reviewed publications with collaborators	Quarterly	60	≥80
	Technology and knowledge transfer	Commercial (commissioned) reports	Annually	180	>200
	Science quality	Impact of scientific publications	Annually	H=46.7 C=6.75	H index 50 Citations 7
	Financial indicator	Revenue per FTE (\$)	Quarterly	\$154,319	\$160,767
	Stakeholder engagement	Relevant funding partners and other end users (number and per cent) that have a high level of confidence that Scion sets research priorities relative to the forest industry and biomaterials sector	Biennial	2013 n=50; 77%	MBIE survey n>30; >85%
	National and international research providers (%) who have a high level of confidence in Scion's ability to assemble the most appropriate research team	Biennial	85%	>85%	
	Relevant end-users (%) who have adopted knowledge and/or technology from Scion	Biennial	94%	>90%	
SCION STRATEGIC INDICATORS	Māori economic development	Partnerships (number and value) established with Māori entities to support economic development through the forest industry	Quarterly	6, \$1.0m	n>5; >\$1.0m
	Accelerated commercialisation	Technologies in Scion's pipeline (number and co-investment (\$)); projects that progress to the business case stage (case studies)	Quarterly	21 \$400k 6	25 & \$600k; Cases ≥4pa
	Internationalisation	Joint research and technology development programmes and staff exchanges with Scion's international strategic partner organisations	Six monthly	4 N/A	<5 1
	People and culture	Staff recruitment and retention (quality and days to fill); leadership development (assessment); good employer (EEO rating); health and safety; and internal staff satisfaction survey (biennial)	Annual and Biennial	Qualitative 43 days 6 0	Qualitative <50 days EEO rating 0 Zero harm
	Organisational productivity	Development and application of the Scion Way 'best practice' suite (internal evaluation; ratio overheads (O/Hs): total revenue (%))	Annual	18% 75%	O/Hs <20% 100%

Table 10: Scion's performance monitoring scorecard indicators and measures.

# 9. Concluding comments

The forest industry has a big role to play in growing New Zealand's exports, achieving improved national environmental outcomes and supporting the vibrancy of rural regions. Export earnings from forest and wood products have grown strongly in recent years, especially from China. The recovery now well underway in housing starts (domestically and internationally) and the continued expansion of emerging markets for renewable materials, 'green' chemicals and bioenergy products will boost earnings further and directly support the Government's Business Growth Agenda goal of lifting the ratio of exports to gross domestic product to 40% by 2025<sup>52</sup>.

With New Zealand's log harvest growing by about 10 million m<sup>3</sup> over the next decade to 33+ million m<sup>3</sup>, more attention must be paid to understanding and developing high margin export markets for radiata pine products. The WoodScape study<sup>53</sup> confirmed the importance of increasing New Zealand wood processing competitiveness through product innovation, greater efficiency, market development and supply chain coordination. Development of wood processing in New Zealand would reduce forest growers' high exposure (circa 70% in 2013/14) to the Chinese log market.

Developing commercial scale and export returns from non-radiata forestry species is also important in meeting growing market demand for durable (non-treated) timber; realising the \$285 million potential revenues from New Zealand's privately owned indigenous forests<sup>54</sup> and in mitigating the exposure of New Zealand plantation forests to biosecurity and climate change risk.

Improving the competitiveness of forestry as a land use in order to increase replanting and new planting rates to about 60,000 hectares of new forest per year is also important

for the industry's long-term viability and the attraction of new investors in wood processing. The 2020+ outlook for a global shortfall in softwood log supply; likely recovery of the carbon price post 2015; development of other markets for forest-based ecosystem services (such as biodiversity); and, the imperative to reduce nutrient pollution of waterways and estuaries are positive drivers for forestry as a land use. However, there are immediate opportunities for forest growing research to improve forestry returns through improved tree genetics and nutrition, matching genotypes to sites, and reducing impacts of foliar diseases. Through these means, volume growth of forests could be doubled over the next 20 years to 35 tonnes of biomass per hectare per year while concurrently improving wood uniformity and stiffness<sup>55</sup>.

Māori have an increasing role in all of these areas of forest industry development. Therefore Scion plans to continue to strengthen and establish further partnerships with Māori trusts and incorporations with significant forest assets and large areas of under-utilised land with good potential for forestry<sup>56</sup>.

Scion is well positioned with forest industry stakeholders and firms in the steadily emerging non-forest sourced biomaterials sector to achieve gains in all of these areas. Its refreshed science plan and core funding portfolio are designed to exploit changes in the external operating environment and maximise opportunities for the forest industry through the National Science Challenges, regional development initiatives, international collaboration and by working closely with Callaghan Innovation and government departments.

<sup>52</sup> See <http://www.mbie.govt.nz/what-we-do/business-growth-agenda/export-markets> for detailed information about the Government's business growth agenda. Sourced 18 March 2014.

<sup>53</sup> WoodScape. (2013). *Summary Report: Overall outcomes, key messages and recommendations for next steps*. [http://www.woodco.org.nz/images/stories/pdfs/woodscape/woodscapesummaryreportfinal1\\_web.pdf](http://www.woodco.org.nz/images/stories/pdfs/woodscape/woodscapesummaryreportfinal1_web.pdf)

<sup>54</sup> KPMG. (2013). *Indicative value analysis of New Zealand's privately owned indigenous forests*. <http://www.mpi.govt.nz/portals/0/documents/forestry/forestry-nz/ind-forestry/indicative-value-analysis-indigenous-forests.pdf>

<sup>55</sup> Forest Owners Association. (2012). *New Zealand forestry science and innovation plan*. <http://www.forestvoice.org.nz/docs/foaforestgrowingstrategy240112v15.pdf>

<sup>56</sup> Ministry of Primary Industries. (2013). *Growing the productive base of Māori freehold land*. Wellington, New Zealand. Retrieved 18 March 2014 from <http://www.mpi.govt.nz/Default.aspx?TabId=126&id=1734>

# 10. Glossary

Biomass	A renewable energy source - biological material from living or recently living organisms, e.g. trees
Bioplastics	Plastics derived from renewable biomass sources
Biopolymers	Polymers produced from renewable biomass sources
Biorefinery	A facility that integrates biomass conversion processes and equipment to produce any combination of fuels, power, heat, wood products/fibres and chemicals from biomass
Composites	Products produced through mixing different materials, e.g. medium density fibreboard
Hapū	Section of a large tribe; clan; secondary tribe
Impact Key Performance Indicators (KPI)	Underpinning each Intermediate Outcome are Key Performance Indicators (achieved within a 3 to 5 year timeframe) to gauge progress towards achieving the Intermediate Outcomes/Impacts
Intermediate Outcomes/ Impacts (IO)	Science outcomes delivered by Scion
Iwi	Tribe; nation; people
Mātauranga	Knowledge
Mean Annual Increment	The annual increase in tree volume per hectare per year
National Outcomes	The national impacts as stated in a Crown Research Institute's Statement of Core Purpose
Ngahere	Forest
Phytosanitary	Relates to the health of plants usually in the context of demonstrating freedom from pests
PTA	<i>Phytophthora</i> taxon Agathis
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
Solid wood	This includes timber and engineered wood products such as laminated timber, laminated veneers and finger-jointed wood (also called engineered wood products)
Rōpu	Society; group; company of people
Taonga	Property; treasure; artefact; relic; anything highly prized
Te reo	Voice; language
Tikanga	Customs and traditions

# Appendix 1: Forest growing sector description

## NATIONAL EXOTIC FOREST ESTATE STATISTICS 2013

### AREA AND STANDING VOLUME STATISTICS AS AT 1 APRIL 2013

#### FOREST AREA

Net stocked area (ha)	1,728,500
Harvested area awaiting replanting (ha)	51,869
Total forest area	1,780,369

#### GROWTH CHARACTERISTICS

Standing volume (000 m <sup>3</sup> )	512,137
Average standing volume (m/ha)	296
Area-weighted average age (years)	16.8

#### AREA BY SPECIES

Radiata pine (ha)	1,553,700
Douglas-fir (ha)	106,500
Cypress species (ha)	10,100
Other softwoods (ha)	23,600
Eucalyptus species (ha)	22,000
Other hardwoods (ha)	12,600

#### RADIATA PINE AREA BY TENDING REGIME

Pruned with production thinning (ha)	203,300
Pruned without production thinning (ha)	687,200
Unpruned with production thinning (ha)	40,800
Unpruned without production thinning (ha)	622,300

#### PLANTING STATISTICS

YEAR ENDED  
31 DECEMBER 2012

#### NEW PLANTING

Total estimated new planting (ha)	11,500
Restocking (ha)	45,154

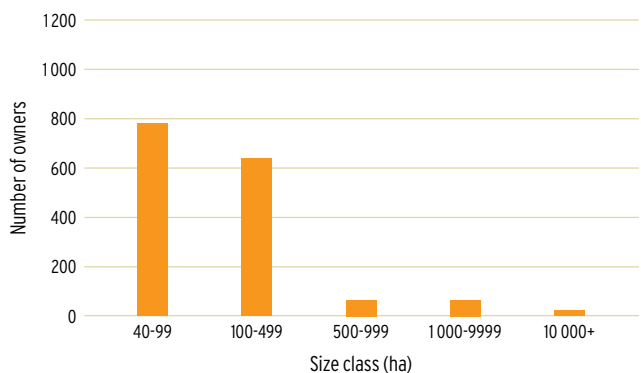
#### HARVESTING STATISTICS

YEAR ENDED  
31 DECEMBER 2012

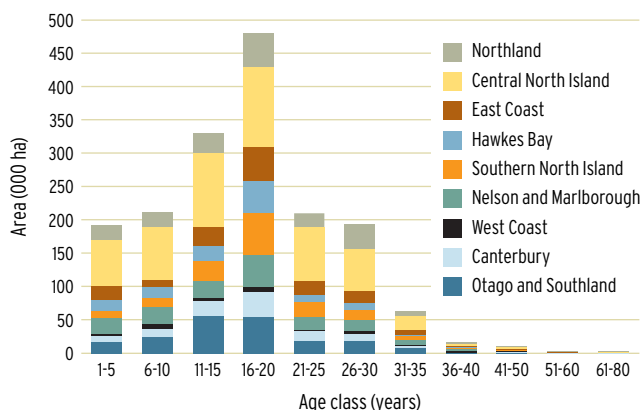
#### HARVESTING

Area clear felled - all species (ha)	50,342
Area clear felled - radiata pine (ha)	47,384
Volume clear felled - all species (000 m <sup>3</sup> )	26,296
Volume production thinned - all species (000 m <sup>3</sup> )	307
Total volume removed - all species (000 m <sup>3</sup> )	26,603
Average clear fell yield - all species (m/ha)	522
Volume clear felled - radiata pine (m <sup>3</sup> /ha)	25,131
Average clear fell yield - radiata pine (m <sup>3</sup> /ha)	530
Area-weighted average clear fell age for radiata pine (years)	27.7

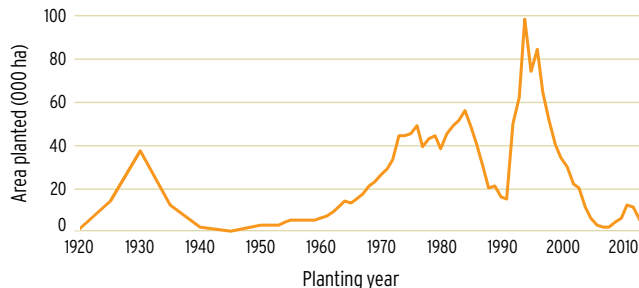
## NUMBER OF FOREST OWNERS BY NATIONAL SIZE CLASS



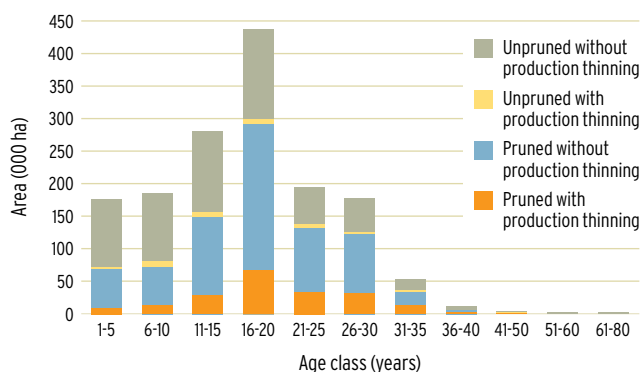
## FOREST AREA BY AGE CLASS AND WOOD SUPPLY REGION



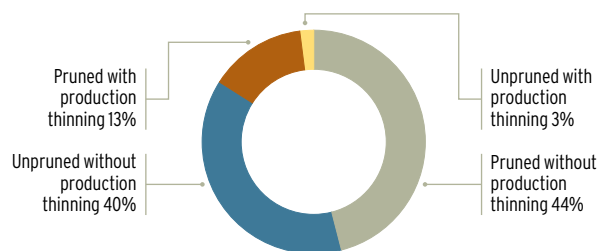
## NEW FOREST PLANTING 1920 - 2013 (PROVISIONAL)



## RADIATA PINE FOREST AREA BY AGE CLASS AND TENDING REGIME, AS AT 1 APRIL 2013



## RADIATA PINE BY TENDING REGIME - 2013



These tables and figures are sourced from the Ministry for Primary Industries' report *National exotic forest description as at 1 April 2013*.

## Appendix 2: Forest industry value chain overview

### FORESTRY PRODUCTION

VOLUME (TONNES unless otherwise stated)	JUNE YEAR		
	2012	2013	% CHANGE
Panel products (m <sup>3</sup> )	1,963,703	1,827,974	-6.0%
Export logs (m <sup>3</sup> )	12,966,198	14,956,246	15.3%
Pulp	1,540,884	1,477,766	-4.1%
Paper and paperboard	857,262	790,152	-7.8%
Sawn timber (m <sup>3</sup> )	3,885,650	3,991,238	2.7%
Total roundwood removals (m <sup>3</sup> )	26,431,016	28,275,146	7.0%

Source: MPI

### FORESTRY EXPORTS

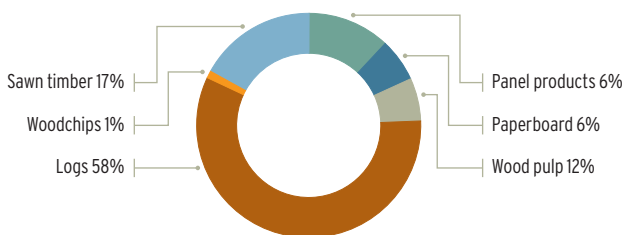
VALUE (\$NZ MILLION FOB)	2012	2013	% CHANGE
Panel products	494	436	-11.7%
Logs, poles and wood chips	1,567	1,921	22.6%
Pulp	565	544	-3.7%
Paper and paperboard	376	337	-10.4%
Sawn timber and sleepers	763	794	4.1%
Other	507	447	-11.8%
Total	4,272	4,479	4.8%

VOLUME (TONNES  
unless otherwise stated)

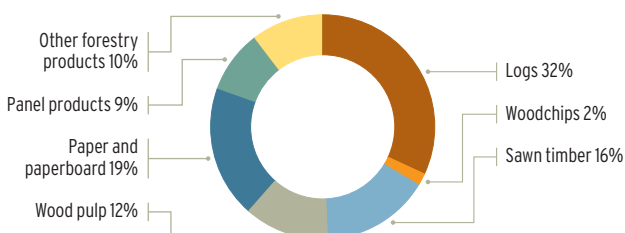
Panel products (m <sup>3</sup> )	954,612	870,160	-8.8%
Logs and poles (m <sup>3</sup> )	12,966,198	14,956,246	15.3%
Pulp	828,148	875,243	5.7%
Paper and paperboard	377,290	364,923	-3.3%
Sawn timber and sleepers (m <sup>3</sup> )	2,046,634	2,079,745	1.6%
Woodchips (BDU)	403,326	354,559	-12.1%

Sources: Statistics New Zealand and MPI  
Note: excludes newsprint exports

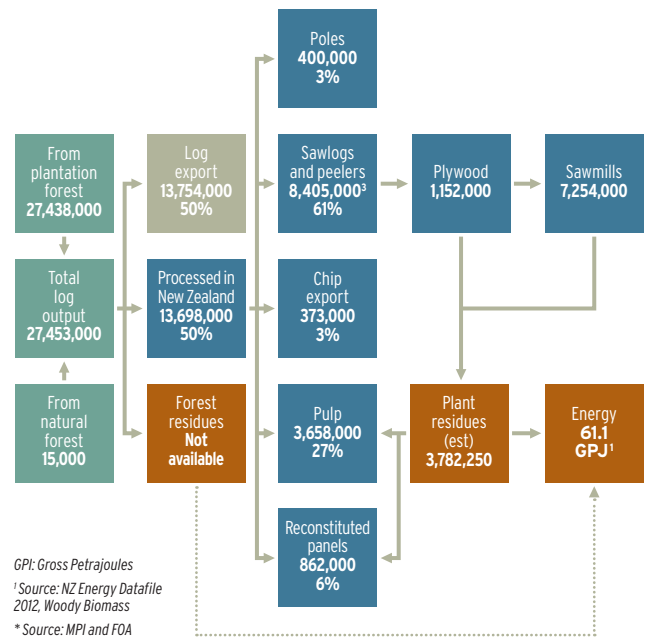
### NEW ZEALAND EXPORTS BY VOLUME (RWE)



### NEW ZEALAND EXPORTS BY VALUE

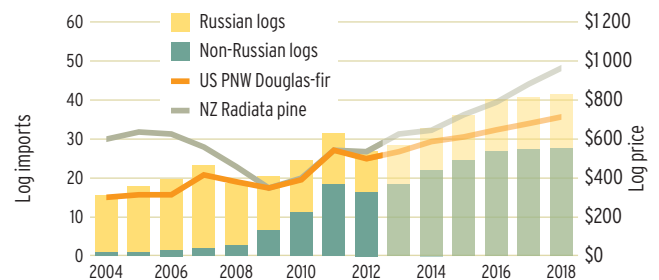


### LOG FLOW IN THE NEW ZEALAND FOREST INDUSTRY



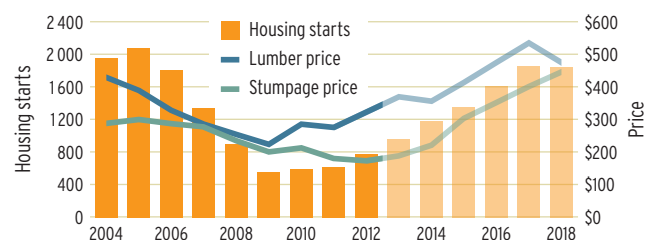
Volumes in (m<sup>3</sup>) roundwood equivalent. Year ended 31 December 2012.\*

### CHINESE LOG DEMAND WILL REMAIN ROBUST



Chinese softwood log imports (million m<sup>3</sup> per year) and softwood log prices (\$ per MBF, AMG or AWG)

### US HOUSING RECOVERY WILL BOOST LUMBER AND TIMBER PRICES



US Housing starts (1 000 units per year), softwood lumber price (\$ per MBF), and Southern Pine Stumpage price (\$ per MBF)

The data in these tables and figures are sourced from *Primary Industries production and trade June quarter 2013*, Ministry for Primary Industries; *New Zealand plantation forest industry facts and figures 2012/2013*, Forest Owners Association; ANZ; Statistics NZ and a New Zealand forest management company.



## Appendix 3: Scion's business policies

Scion aims to remain a high quality, financially viable research organisation with an exemplary international reputation, while providing relevant outputs to the highest standards of professionalism and maintaining prudent business practices.

Below is a brief summary of Scion's business policies. Further details can be found at [www.scionresearch.com](http://www.scionresearch.com).

### Statutory requirements policy

Scion will operate in accordance with relevant legislative requirements, including the Crown Research Institutes Act 1992, Companies Act 1993, and the Crown Entities Act 2004. In doing so, Scion will undertake business according to the following commitments.

### Policy on acquisitions, mergers and divestments

Scion will strive to continuously add value to its activities and improve the net worth of the company and its shareholders. It will ensure that all new investments within core business, expansions of core business and diversification away from core business, will ordinarily provide shareholders with additional economic value commensurate with the risks involved. Scion will seek shareholder consent where the value of the proposed acquisition or divestment is greater than 30% of the total assets (taken as a whole) or \$5 million whichever is the lesser.

### Business strategies

In order to achieve its Statement of Core Purpose, Scion will:

- Adopt a 'customer centric' approach to develop strong long-term partnerships with key stakeholders in the firms, representative bodies, iwi and government agencies working with and supporting the forest industry.
- Establish collaborative relationships with research providers both within New Zealand and overseas to enhance the impact and quality of Scion's science.
- Build public understanding of the implications of our science and the economic, social and environmental value it creates.
- Seek early commercial investment to support the development and uptake of Scion invented technologies.
- Reinvest operating surpluses to develop Scion's research capabilities, infrastructure, collaborations and to accelerate the rate of innovation along the wood-fibre value chain.

### Human resources policies

Scion aims to be a good employer. It will recruit people whose competencies match the requirements to achieve its strategy and vision. The organisation's policies and procedures aim to ensure equal opportunity for all, that people are developed to their full potential, achieve an

appropriate 'work-life' balance and that there is compliance with employment, health and safety and associated legislation. Scion will remunerate staff on the basis of performance and the company's ability to pay through a combination of organisational and individual merit based payments. A competency-based appraisal system and objective performance output measures will be applied to assess both individual and team performance.

### Intellectual property policies

The primary goal of the Intellectual Property (IP) management policies is to ensure that the interests of both the Crown and Scion and any client IP with which Scion is entrusted are protected, that knowledge and expertise are managed appropriately, the health of the IP portfolio is monitored continuously, and technological innovations are commercialised effectively.

### Risk policy

Scion has risk management and compliance processes in place and operating effectively across the organisation. The risk management framework identifies, classifies, reports on and mitigates business risk. Risk reporting is undertaken on a quarterly basis to the Scion Board or as a risk arises.

### Accounting policies

Scion will manage cash prudently and ensure that any surplus cash is invested within delegations approved by the Board. New Zealand equivalents to International Financial Reporting Standards approved by the New Zealand Institute of Chartered Accountants for the measurement and reporting of profit and financial position have been adopted by Scion. (Refer to Appendix 4.)

### Dividend policy

The Scion Board will detail in a submission to shareholding Ministers, within three months of the end of each financial year:

- The amount of dividend (if any) recommended to be distributed to the shareholders.
- The percentage of tax-paid profits that the dividend represents.
- The rationale and analysis used to determine the amount of any dividend.

### Treatment of land claims

Scion monitors the progress of, and will seek to provide input as appropriate into, land claims or other matters affecting the land occupied by Scion in Rotorua.

Two land claims affecting the Rotorua campus currently exist:

- Ngāti Whakaue - covering the total site.
- Ngāti Wahiao - covering the southern end of the site.

## Appendix 4: Statement of accounting policies

### Reporting entity

New Zealand Forest Research Institute Limited is a Crown Research Institute registered under the Companies Act 1993. The registered office is Te Papa Tipu Innovation Park, 49 Sala Street, Rotorua. The group consists of New Zealand Forest Research Institute Limited and its subsidiaries.

New Zealand Forest Research Institute Limited (the Company) is a reporting entity for the purposes of the Financial Reporting Act 1993. It is domiciled and incorporated in New Zealand and is wholly owned by the Crown.

The Financial Statements of New Zealand Forest Research Institute Limited for the year were authorised for issue in accordance with a resolution of the directors on the date as set out on the Statement of Financial Position.

The activities of New Zealand Forest Research Institute Limited include a range of research and development programmes aimed at using plant-based renewable resources and waste streams to create new materials, energy sources and environmentally sustainable products and processes.

New Zealand Forest Research Institute Limited trades as Scion and these names have identical meaning in this report.

### 1.1 Summary of significant accounting policies

#### a) Basis of preparation

The financial statements have been prepared in accordance with generally accepted accounting practice in New Zealand (NZ GAAP) and the requirements of the Companies Act 1993 and the Financial Reporting Act 1993. The financial statements have also been prepared on a historical cost basis, except for forestry assets and certain heritage assets that have been measured at fair value.

The financial statements are presented in New Zealand dollars and all values are rounded to the nearest thousand dollars (\$000).

#### b) Statement of compliance

The financial statements have been prepared in accordance with NZ GAAP. They comply with New Zealand equivalents to International Financial Reporting Standards, and other applicable Financial Reporting Standards, as appropriate for profit-oriented entities. The financial statements comply with International Financial Reporting Standards (IFRS).

#### c) Basis of consolidation

The consolidated financial statements include the parent company and its subsidiaries. All intercompany transactions and unrealised profits and losses between the group of companies are eliminated from the financial statements on consolidation. In the parent company financial statements, investments in subsidiaries are stated at cost less any impairment charges.

#### d) Associate companies

These are companies in which the group holds substantial shareholdings but does not have control and in whose commercial and financial policy decisions it participates.

Associate companies have been reflected in the consolidated financial statements on an equity accounting basis which shows the group's share of surpluses in the Consolidated Statement of Comprehensive Income and its share of post acquisition increases or decreases in net assets, in the Consolidated Statement of Financial Position.

#### e) Intangible assets

Intangible assets acquired separately are capitalised at cost and from a business combination are capitalised at fair value as at the date of acquisition. Following initial recognition, the cost model is applied to the class of intangible assets.

The useful lives of these intangible assets are assessed to be either finite or indefinite.

Where amortisation is charged on assets with finite lives, this expense is recognised in profit and loss.

Intangible assets created within the business are not capitalised and expenditure is charged to profit and loss in the year in which the expenditure is incurred.

Intangible assets are tested for impairment where an indicator of impairment exists, and in the case of indefinite life intangibles, annually, either individually or at the cash generating unit level. Useful lives are also examined on an annual basis and adjustments, where applicable, are made on a prospective basis.

A summary of the policies applied to the group's capitalised intangible assets is as follows:

	Software
Useful lives	Finite
Method used	4 years - Straight line
Type	Acquired
Impairment test/ Recoverable amount testing	Amortisation method reviewed at each financial year-end; Reviewed annually for indicators of impairment

Gains or losses arising from derecognition of an intangible asset are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognised in the profit and loss when derecognised.

#### f) Biological assets

Biological assets consist entirely of tree plantations which are measured at fair value less any point of sale costs. Gains and losses arising on initial recognition or change in fair value, less estimated point of sale costs, are included in profit and loss in the period in which they arise.

The fair value of tree plantations is determined by an independent valuer.

The valuation method for immature trees is the net present value of future net harvest revenue less estimated costs of owning, protecting, tending and managing trees. For mature trees fair value is deemed to be the net harvest revenue value.

**g) Property, plant and equipment**

All items of property, plant and equipment are valued at the cost of purchase from the Crown as at 1 July 1992 adjusted for subsequent additions at cost, disposals and depreciation. Plant and equipment are recorded at cost less accumulated depreciation. Land and capital work in progress are recorded at cost. Some library books have been identified as heritage assets and are recorded at fair value as determined by an independent valuer. Valuations are obtained every five years or more often where circumstances indicate that a significant change in fair value has occurred.

Expenditure incurred on property, plant and equipment is capitalised where such expenditure will increase or enhance the future benefits provided by the asset. Expenditure incurred to maintain future benefits is classified as repairs and maintenance.

When an item of property, plant and equipment is disposed of the difference between the net disposal proceeds and the carrying amount is recognised as a gain, or loss, in profit and loss.

Depreciation is provided for using the straight-line method to allocate the historical cost, less an estimated residual value, over the estimated useful life of the asset.

The useful lives of the major classes of assets have been calculated as follows:

Buildings and Land Improvements	40-60 years
Plant and Equipment	4-15 years
Furniture and Fittings	10 years
Motor Vehicles	3-7 years
Library Books	20 years

**h) Recoverable amount of non-current assets**

At each reporting date, the group assesses whether there is any indication that an asset may be impaired. Where an indicator of impairment exists, the group makes a formal estimate of recoverable amount. Where the carrying amount of an asset exceeds its recoverable amount the asset is considered impaired and is written down to its recoverable amount.

Recoverable amount is the greater of fair value less costs to sell and value in use. It is determined for an individual asset, however, if the asset's value in use cannot be estimated to be close to its fair value less costs to sell, and it does not generate cash inflows that are largely independent of those from other assets or groups of assets, it is determined for the cash-generating unit to which the asset belongs.

In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects current market assessments of the time value of money and the risks specific to the asset.

**i) Trade receivables**

Trade receivables are initially recognised at fair value and subsequently valued at amortised cost less impairment allowance.

Collectability of trade receivables is reviewed on an ongoing basis. Debts that are known to be uncollectible are written off when identified. An allowance for doubtful debts is raised when there is objective evidence that it is probable the group will not be able to collect the debt. Financial difficulties and payment defaults without explanation are considered objective evidence of impairment.

**j) Inventories**

Consumable stores are valued at the lower of cost, on a weighted average price of stock on hand, and net realisable value.

Nursery stocks are valued at lower of cost or net realisable value. Changes in net realisable value are recognised in the profit and loss account in the period in which they occur.

**k) Research costs**

Research costs are expensed in the period incurred.

**l) Provisions and employee benefits**

Provisions are recognised when the group has a present obligation (legal or constructive) as a result of a past event, it is probable that an outflow of resources embodying economic benefits will be required to settle the obligation and a reliable estimate can be made of the amount of the obligation.

Provisions are measured at the present value of management's best estimate of the expenditure required to settle the present obligation at the Statement of Financial Position date using a discounted cash flow methodology.

*(i) Wages, salaries and annual leave*

The liability for wages, salaries and annual leave recognised in the Statement of Financial Position is the amount expected to be paid at balance date. Provision has been made for benefits accruing to employees for annual leave in accordance with the provisions of employment contracts in place at balance date.

*(ii) Long service leave*

The liability for long service leave is recognised and measured as the present value of expected future payments to be made in respect of services provided by employees up to the reporting date using the projected unit credit method. Consideration is given to expected future wage and salary levels, experience of employee departures, and periods of service. Expected future payments are discounted using market yields at the reporting date on national government bonds with terms to

maturity and currencies that match, as closely as possible, the estimated future cash outflows.

*(iii) Defined benefit plan*

The defined benefit plan is unfunded. The cost of providing benefits under the defined benefit plan is determined using the projected unit credit actuarial valuation method. Actuarial gains and losses are recognised in the profit and loss account in the period in which they arise.

The defined benefit liability recognised in the Statement of Financial Position represents the present value of the defined benefit obligations.

Long service leave and retirement leave provisions are based on an actuarial valuation.

**m) Leases**

*Group as a lessee*

Operating lease payments, where the lessors effectively retain substantially all the risks and benefits associated with ownership of the leased items, are included as an expense in the profit and loss in equal instalments over the lease term.

*Group as a lessor*

Leases in which the group retains substantially all the risks and benefits of ownership of the leased asset are classified as operating leases. Initial direct costs incurred in negotiating an operating lease are expensed as incurred.

**n) Cash and cash equivalents**

Cash and short-term deposits in the Statement of Financial Position comprise cash at bank and in hand and short-term deposits with an original maturity of six months or less.

For the purposes of the Statement of Cash Flows, cash and cash equivalents consist of cash and cash equivalents as defined above, net of outstanding bank overdrafts.

**o) Goods and Services Tax (GST)**

The financial statements are prepared on a GST exclusive basis.

**p) Foreign currencies**

*Functional and presentation currency*

Both the functional and presentation currency of New Zealand Forest Research Institute Limited and its subsidiaries is New Zealand dollars.

*Transactions and balances*

Transactions in foreign currencies are initially recorded in the functional currency by applying the exchange rates ruling at the date of the transaction. Monetary assets and liabilities denominated in foreign currencies are retranslated at the rate of exchange ruling at the Statement of Financial Position date.

Non-monetary items that are measured in terms of historical cost in a foreign currency are translated using the exchange rate as at the date of the initial transaction. Non-monetary items measured at fair

value in a foreign currency are translated using the exchange rates at the date when the fair value was determined.

**q) Revenue recognition**

*Research revenue*

Research revenue from both Government and commercial sources is recorded when earned based on the percentage of work completed. Percentage of work completed is based on management judgement, after considering costs incurred and other contracted commitments. Work completed but not invoiced is recorded as accrued revenue while work invoiced but not completed is recorded as revenue in advance.

Government revenue includes revenue received from the Ministry of Business, Innovation and Employment in the form of core funding, Public Good Science and Technology Investment, and Preseed Accelerator Fund programmes. Funding includes both devolved and milestone related programmes. Government revenue has only been recognised after all appropriate conditions have been met.

*Sale of goods*

Revenue is recognised when the significant risks and rewards of ownership of the goods have passed to the buyer. Risk and reward are considered passed to the buyer at the time of delivery.

*Interest revenue*

Interest revenue is recognised when earned based on applicable interest rates applied to the group's cash deposit balances.

**r) Taxation**

The income tax expense charged to the profit and loss includes both the current year's provision and the income tax effects of temporary differences calculated using the liability method.

Tax effect accounting is applied on a comprehensive basis to all temporary differences. A debit balance in the deferred tax account, arising from temporary differences or income tax benefits from income tax losses, is only recognised if it is probable there will be taxable profits available in the future against which the deferred tax asset can be utilised.

Subsequent realisation of the tax benefit is subject to the requirements of income tax legislation being met.

**s) Borrowing costs**

Borrowing costs are recognised as an expense when incurred except for those borrowing costs determined as directly attributable to the acquisition, construction or production of a qualifying asset (i.e. an asset that necessarily takes a substantial period of time to get ready for its intended use or sale).

**t) Interest-bearing loans and borrowings**

All loans and borrowings are initially recognised at the fair value of the consideration received net of issue costs associated with the borrowing.

After initial recognition, interest-bearing loans and borrowings are subsequently measured at amortised cost using the effective interest method. Amortised

cost is calculated by taking into account any issue costs, and any discount or premium on settlement.

For the purpose of valuing bank borrowings, the bank interest rate is taken as the discount rate. As such the bank borrowings are carried at the value of the debt with the bank.

**u) Trade and other payables**

Trade and other payables are carried at amortised cost and due to their short term nature they are not discounted. They represent liabilities for goods and services provided to the group prior to the end of the financial year that are unpaid and arise when the group becomes obliged to make future payments in respect of the purchase of these goods and services. The amounts are unsecured and are usually paid within 60 days of recognition.

**v) Derivative financial instruments and hedging**

The group uses derivative financial instruments such as forward currency contracts to hedge its risks associated with foreign currency fluctuations. These derivative financial instruments are initially recognised at fair value on the date on which a derivative contract is entered into and are subsequently remeasured to fair value.

Derivatives are carried as assets when their fair value is positive and as liabilities when their fair value is negative.

Derivative assets and liabilities held for the purpose of trading are classified as current in the statement of financial position. Derivative assets and liabilities are classed as non-current when the remaining maturity is more than 12 months, or current when the remaining maturity is less than 12 months.

The fair values of forward currency contracts are calculated by reference to current forward exchange rates for contracts with similar maturity profiles.

Any gains and losses arising from changes in the fair value of derivatives, except for those that qualify as cash flow hedges, are taken directly to profit or loss for the year. The group does not apply hedge accounting.

## 1.2 Significant accounting judgements, estimates and assumptions

**a) Revenue recognition**

Revenue is recognised based on the percentage of work completed on a project basis. Percentage of work completed is based on management judgement after considering such things as hours completed, costs incurred, milestones achieved and actual results to date.

**b) Heritage assets**

The group holds several heritage assets which have significant value due to being both rare, and having importance to the nation. Where a heritage cost can be measured reliably they are revalued at least every five years and included as part of property plant and equipment.

Due to the nature of some heritage assets, management does not believe they can be valued reliably. These assets have been identified as disclosed.

**c) Biological assets**

The group's biological assets consist of tree plantations. These are valued at the net present value of future net harvest revenue less estimated costs of owning, protecting, tending and managing trees. The valuation process includes several judgements and estimations around discount rates, future costs, and future prices. Management used the experience of a registered forestry valuer to reduce the risk of misstatement resulting from these judgements and estimates.

**d) Defined benefit scheme**

The group operates an unfunded defined benefit plan. Significant assumptions used involving the plan include the discount rate and future salary increases as set out in the notes to the financial statements. Management used the experience of a registered actuary to reduce the risk of misstatement resulting from these judgements and estimates.









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