RIGHT TREE, RIGHT PLACE, RIGHT PURPOSE

Scion strategy to 2030

incorporating
Statement of Corporate Intent
2018-2023

SCION™
FORESTS ▪ PRODUCTS ▪ INNOVATION

Contents

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Chair and Chief Executive overview

Forestry is recognised globally as a key part of a low-carbon, biobased economy.

The world is changing at a much faster pace than the impact of the industrial revolution 200 years ago. Technological change and new business models are threatening businesses and countries that do not adapt. Climate change action seeks to mitigate rising greenhouse gas emissions. Concern about access to clean water is worldwide, and current unsustainable land use practices are no longer acceptable.

A successful bioeconomy is an innovative, low-emissions economy, created through the merging of sectors and industries to ensure a sustainable supply of food and other products, while maintaining biodiversity and environmental protection.

Both OECD and emerging nations are adopting the bioeconomy approach, which uses renewable resources from the land and sea, as well as waste, as inputs to feed, food, industrial products and energy production. The circular economy concept is intrinsically linked to the bioeconomy as the waste from one process becomes the feedstock for another.

Like other nations, New Zealand needs to respond to these global drivers now. Specifically our challenges include:

- Demand for a better balance of economic, environmental and social outcomes.
- Climate change obligations.
- Demand for sustainable growth and sustainable production.
- Export returns affected as traditional business and commodity models become less viable.
- Low productivity compared with other countries.
- Vulnerability of production ecosystems to increases in abiotic and biotic risks.
- Changing global trade dynamics.

It is exciting that New Zealand is well positioned globally with existing forestry capability and resources in pulp, paper and wood manufactured products, a clean, green image and rising opportunities in our regions.

The role of the world's indigenous peoples in shaping the future well-being of communities, nations and enterprises is increasingly recognised. One of our specific challenges is how best to embrace kaupapa Māori.

As we worked through the challenges and opportunities ahead, we concluded that forestry could enable very significant outcomes for New Zealand socially, environmentally and economically. We have set these outcomes as Scion's aspirational goals for New Zealand by 2050.

In 2050, through the power of forestry, New Zealand will have:

- 10-fold increase in GDP from forests and manufacturing
- Zero carbon emissions
- Erodible land planted in permanent forests
- Water quality issues from land use mitigated
- Sustainable communities and economies in all regions
- High OECD household net wealth ranking
- A top five ranking in OECD better life index

In our future view of New Zealand, Scion, with industry, government and Treaty partners, will have grown and transformed forestry and timber-based manufacturing. Regions across New Zealand will be thriving through their expanded and enriched planted forests. High-value construction and appearance timber products will be meeting domestic and international demand. New materials and energy derived from trees will have displaced oil-derived products.

New biobased industries that use tree- and wood waste-derived materials will have replaced those that relied on imported chemicals and fuels. Timber will be the norm in multi-level construction, and New Zealand cities will be increasingly sustainable in character and design.

Trees will make up more of the rural and urban landscapes as major contributors to mitigating climate change and protecting and enhancing our environment.

Today, new government policies and initiatives align with the path we are blazing. These include the one billion trees programme, the $1 billion per annum Provincial Growth Fund, a Zero Carbon Act and the establishment of an independent Climate Change Commission, a focus on Crown/Māori relationships, housing programmes, establishment of Te Uru Rākau - Forestry New Zealand and the Predator Free 2050 programme along with the National Policy Statement for Freshwater Management, Biosecurity 2025 Direction Statement and the New Zealand Biodiversity Strategy 2000-2020.

Scion's role in enabling New Zealand to benefit from global and local challenges and opportunities is set out in our Statement of Core Purpose and summarised in our mission statement:

Our 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."

Our Mission

Enhancing New Zealand's prosperity, well-being and environment through trees. *Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.*

In this strategic plan through to 2030 we have set out our long-term direction and programmes of work to deliver our purpose and achieve great outcomes for New Zealand.

It will be critical to do this work in partnership with existing and emerging industry, Māori and central and local government. Through the impact of our research and development, and our partnerships, Scion will play a key role in recasting New Zealand's forest industry to create a more sustainable and uniquely New Zealand way of living in a low-carbon, biobased future.

We will help develop distinctive New Zealand products, services and approaches that will enhance our nation's well-being through social, environmental and economic outcomes while also demanding a value premium around the world. We will enable opportunities for producers to develop New Zealand brands that promote a powerful 'biobased' and 'made-from-sustainably grown and managed trees' message.

We have defined three research impact areas to 2030 that focus where we will apply our expertise to deliver maximum impact for New Zealand.

Forests and landscapes

To grow healthy, resilient forests that are planted primarily for their standing-forest benefits.

> By 2030, social, cultural, environmental and economic benefits of these forests (exotic and indigenous) are fully valued, for example carbon sequestration, biodiversity (niches for endangered species), erosion and flood control, enhanced water quality, recreation and tourism.

High-value timber manufacturing and products

To grow healthy, resilient forests that produce high-value trees for manufacture into products that capture an increasing share of the global high-end market for timber.

> Successful application of current and new forest models producing products for urban applications has the potential to add an extra $10 billion to New Zealand's GDP by 2030. In particular, this is made up of $7 billion in new housing builds and engineered timber applications, 50 per cent increase in new species commercial plantings, harvests and high-value applications, increased exports of processed timber and substitution for imported timber and products.
>
> By 2030, a reduction of 2.5 million tonnes CO_2-e per annum is possible with 1.5 million tonnes increase in CO_2 capture per annum by faster growing trees and greater timber usage in urban buildings.

Biobased manufacturing and products

To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials.

> The potential is to create by 2030 an extra $20 billion to New Zealand's GDP, including $2 billion in fuel and plastics substitutions (imports) and $6 billion in exports. This growth will come from an emerging biorefinery sector producing biochemicals and energy products, new fibre-based materials, new cropping forests and manufacturing processes, as well as several hundred jobs in the regions and 10 million tonne contribution in reduction in CO_2-e.

Our research and development goals embrace this responsibility for New Zealand. As we lay the path to 2030 we set out our deliverables and financial and non-financial indicators for the next five years in our Statement of Corporate Intent 2018-2023.

Tony Nowell CNZM
Chair

Dr Julian Elder
Chief Executive

Our strategy to 2030

Our Mission

Enhancing New Zealand's prosperity, well-being and environment through trees

Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere

Looking out to 2050,

Scion has ambitious aspirations for New Zealand that we believe are achievable through the power of forests to transform how we live.

In 2050, New Zealand will have:

- 10-fold increase in GDP from forests and manufacturing
- Zero carbon emissions
- Erodible land planted in permanent forests
- Water quality issues from land use mitigated
- Sustainable communities and economies in all regions
- High OECD household net wealth ranking
- A top five ranking in OECD better life index

In this 2050 future, forests are a sustainable renewable resource that is pivotal to New Zealand's economic, environmental and social well-being.

To reach this future point Scion is setting goals for 2030 as stepping stones for the 20 years beyond.

Scion brings an underlying strength to the entire forest industry, and the value chain we help create is more critical now than ever before to realise prosperity from trees.

Looking ahead to 2030, Scion's reputation as a respected thought leader will have leapt owing to achievements that have accelerated the development and take up of New Zealand's low-carbon circular bioeconomy.

In 2030, Scion is widely recognised as a provider of excellent science, technological innovation and impact, and for opening up new opportunities for the forest industry and the communities it serves.

With industry, government and Treaty partners we are growing and transforming forestry and timber-based manufacturing. Regions across New Zealand are thriving through their expanded and enriched planted forests. High-value timber products for construction and appearance applications are meeting domestic and international demand. New materials and energy derived from trees are displacing oil-derived products.

New biobased industries that use tree- and wood waste-derived materials have emerged replacing those relying on imported chemicals and fuels. Tall timber buildings are the norm in multi-level construction, and New Zealand cities are increasingly sustainable in character and design. Trees will make up more of the rural and urban landscapes as major contributors to mitigating climate change and protecting and enhancing our environment.

For decades Scion has promoted forests and forestry for multiple benefits. Looking ahead, we know that forests will be at the heart of a low-carbon, biobased future New Zealand. We know too that forests will offset greenhouse gas emissions on a scale unmatched by any current technologies. Now is the time to unleash the power of forestry.

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Our Mission

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Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Scion's Statement of Core Purpose, assigned to us by government, positions us as the lead Crown research institute in sustainable forest management, forestry biosecurity, forestry-based ecosystem services, wood processing, wood related bioenergy, waste streams and other biomaterials.

Our research goals embrace this responsibility for New Zealand. As we lay the path to 2030 we set out our deliverables for the next five years, through to 2023, in our Statement of Corporate Intent. The work we do, however, is not limited to planning timeframes. Our work encompasses multiple timeframes ranging from 100+ years for forests planted for land protection to as little as five years for short-rotation forest crops.

Scion's direction is shaped by many drivers, globally and locally, as described next.

Trees planted as forests can be at the heart of a low-carbon, biobased future New Zealand.

Our world is changing

Disruptive forces are reshaping the global economy at a much, much faster pace than the impact of the industrial revolution 200 years ago. Significant global trends bear upon Scion's core purpose.

The rising global urban population is leading to changing patterns for consumption of food, energy, water, land use and management of environmental impacts. Existing models of food production, material consumption and waste disposal are being challenged. Smart cities require new and different infrastructure and building technologies to reduce greenhouse gas emissions and environmental impacts and improve citizens' quality of life.

By 2050, the world population is expected to be 9.7 billion (up from 7.5 billion currently). The growing middle class has high aspirations for lifestyle, consumer goods, health care and access to rural environments for leisure.

There is increasing recognition of the role of a nation's indigenous people, their connection to the natural world and in shaping the future well-being of communities, nations and enterprises.

Climate change awareness is changing behaviour and driving mitigating activities such as seeking renewable and sustainable outcomes and increasing forest planting. Initiatives stemming from international influencers, like the World Business Council for Sustainable Development and the United Nations Sustainable Development Goals, reach across many countries in a quest to move from an economic reliance on fossil fuels to renewable resources, such as forests. Influenced by consumers, many influential companies and governments are striving to reduce their direct impacts on greenhouse gas emissions.

Concern about access to clean water is worldwide, and current unsustainable land use practices are not acceptable. Trees are seen as the most acceptable and desirable means to sequester carbon and mitigate climate change while enhancing land stability and water quality. The UN Strategic Plan for Forests has a target to increase forest area by 3 per cent worldwide by 2030, and the World Wildlife Fund predicted a 300 per cent increase in demand for wood-based materials and energy between 2010 and 2050. [1]

Key technology disruptors abound like industrial biotechnology and green-tech approaches, light-weighting of automotive and aviation materials, big data, the internet of things, robotics and automation, artificial intelligence, design for sustainability, and new ways of decentralised manufacturing and transformed production systems.

The power of the internet and its ability to reach vast markets has transformed business and the innovation process itself. Authenticity, traceability and evidence for beneficial claims by brand owners are all required. The current approach to managing intellectual property through patenting and licensing may not be viable with the speed of change and open global access to information.

Trade is changing. While distance remains a barrier, the flow of people, capital and data across borders is accelerating, and the speed of doing business is increasing with fast data exchange. More and more physical materials and goods are crossing borders, and more ships and aircraft are arriving at and leaving ports. The export and import environment is changing, such as some manufacturing coming back on shore. Packaging is being redefined as a secure enabler of trade. Exporters are now required to meet more stringent regulations imposed by other countries' requirements, and trade dynamics are shifting – both through new broad alliances that remove barriers and an increase in fortress mentalities from countries that increase barriers.

Increased border traffic heightens biosecurity exposure to every nation. No longer can an island nation like New Zealand regard oceans as barriers to pests and diseases.

The bioeconomy response: Both the Organisation for Economic Co-operation and Development (OECD) and emerging nations are responding to these challenges with approaches to mitigate climate change that alter the underpinning economic philosophy. The most prominent example is the bioeconomy approach, which uses resources such as forests, and waste, as inputs to industrial products and energy production. The circular economy concept is intrinsically linked to the bioeconomy as the waste from one process becomes the feedstock for another. Growing numbers of policies support these initiatives across governments.

The outcome of a successful bioeconomy is an innovative, low-emissions economy, created through the merging of industry sectors to support emerging businesses and industries, and ensure sustainable supplies of food and other products, while maintaining biodiversity and environmental protection.

Around the world, consumers are increasingly demanding sustainable production practices that protect the environment and conserve biodiversity.

The bioeconomy

The world is moving from a dependence on fossil fuels towards a more sustainable biological-based economy – the bioeconomy. The bioeconomy encompasses:

- the production of renewable biological resources, and
- their conversion into food, feed, biobased products and bioenergy via innovative and efficient technologies.

Scion research and development is enabling New Zealand to move from a non-renewable petrochemical-based economy to one using biological processes and renewable materials from planted forests. The biotechnologies we are developing are an exciting prospect for the New Zealand forest industry.

Future opportunities for new industrial bioproducts from trees are huge.

How is New Zealand affected?

Like other nations, New Zealand needs to respond to these global challenges and trends, and Scion will be part of that response.

Now is the time to address:

- Demand for a better balance of economic, environmental and social outcomes.
- Our climate change obligations, which are a significant liability.
- Demand for sustainable growth and production.
- Traditional business and commodity models becoming less viable and affecting export returns.
- Our low productivity, compared with other countries increasing their productivity through science and technology innovations.
- Vulnerability of our production ecosystems to increases in abiotic and biotic risks.
- Changing global trade dynamics, e.g. the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, rising protectionism and technical barriers to trade.

Such problems lead to opportunities for New Zealand. For instance, population growth and consumer demand for sustainably produced goods compels businesses to adopt different approaches; changing trade patterns can open pathways for new products and services; and locating and connecting manufacturing throughout the length of the country can enable regional vibrancy. Such opportunities, embraced broadly across well-integrated sectors, can bring New Zealand a higher standard of living with greater household disposable income.

Government imperatives align with many of these challenges and opportunities. Policies and initiatives that will drive the potential of the forest industry include:

- Increasing afforestation to a target of one billion trees (mixed species for timber and non-timber purposes like land protection or carbon absorption) planted over 10 years. Benefits include income diversification, improved land productivity, job creation and mitigating environmental issues like erosion, water quality and climate change.

> "This will take a combined effort by government, landowners, commercial foresters, conservation groups, regional councils, iwi, communities, and others.
>
> We also want to make sure the right tree is planted in the right landscape. We'll be encouraging planting of both permanent trees and forests that can be harvested in the future." [2]
>
> *Ministry for Primary Industries*, 2018

- $1 billion per year for three years Provincial Growth Fund "to lift productivity potential in the provinces. Its priorities are to enhance economic development opportunities, create sustainable jobs, enable Māori to reach their full potential, boost social inclusion and participation, build resilient communities, and help meet New Zealand's climate change targets." [3]

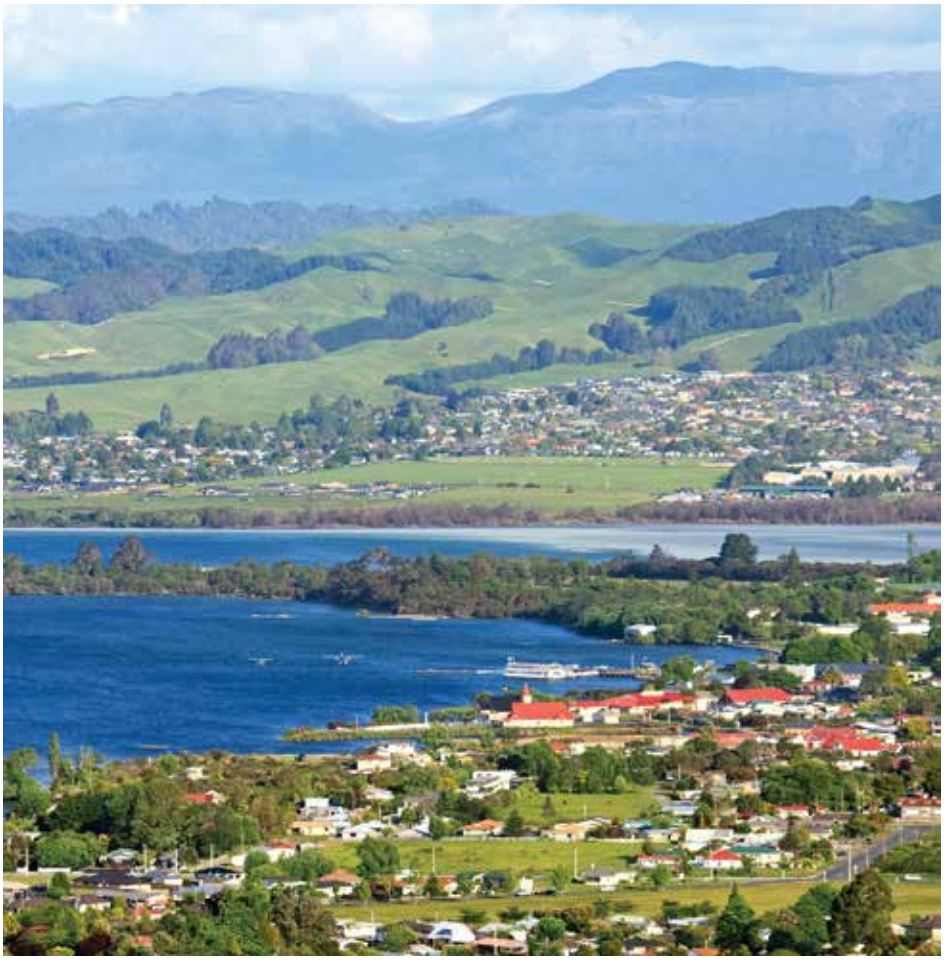
These two initiatives strongly align with Scion's direction, and further key imperatives for Scion are:

- Regional growth studies, and their action plans, that prioritise forestry and wood

processing as the best opportunities for economic growth in certain regions.

- A Zero Carbon Act and establishment of an independent Climate Change Commission provide a long-term approach for climate policy and will provide the framework for a net zero emissions economy by 2050.
- Establishment of Te Uru Rākau - Forestry New Zealand, under the Ministry for Primary Industries and encompassing Crown Forestry, recognises the significant role forestry and related manufacturing and ecosystem services can have on the Government's social, economic and environmental objectives.
- The thriving Māori economy is expected to grow strongly and double to $100 billion by 2030. New Crown/Māori/industry relationships are emerging to foster this distinctive economy and boost the opportunities ahead to forge new ways of connecting, collaborating and co-innovating.
- Affordable housing policies, encompassing the Kiwibuild Programme and Housing New Zealand's social housing reform, aim to build significantly more homes and improve the sustainability and performance of existing homes. Innovative approaches to house building are sought to address homelessness and housing inequality, with flow-on benefits such as improved health and access to education.
- Predator Free 2050, the National Policy Statement for Freshwater Management, Biosecurity 2025 Direction Statement and the New Zealand Biodiversity Strategy 2000-2020 are frameworks and risk management systems to ensure that our native species are protected and the challenges to our productive systems reduced.

Also very pertinent to Scion's business are: the Conservation and Environment Science Roadmap, published in 2017; the Environment Domain Plan 2013, which outlines energy and waste reduction targets; the 30-year New Zealand Infrastructure Plan 2015; the Trade Agenda 2030; and the Primary Sector Roadmap, which guides opportunities for science and technological focus to strengthen the bioeconomy in New Zealand.



Wood for life - *Kia piki te ora*

Through forestry Māori contribute hugely to New Zealand's economy. Forestry is the country's third largest export industry sector. Since 1997, more than 70 state-owned forests have been returned to iwi in Crown Treaty settlements. Māori ownership of land, forests and renewable energy, and related value chains, will increase as settlements conclude and emerging Māori-owned businesses continue to fulfil their aspirations.

Scion recognises how deeply Māori are woven into the national forestry estate. Scion partners, collaborates and co-develops investments with Māori to build the future potential of returned assets.

Iwi forestry is on the eve of a step-change to turn trees into profitability that will help bring improved living standards for future generations. Māori world views and aspirations for economic, environmental and social well-being are in harmony with Scion's mission - Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Scion is working with iwi in Te Tai Tokerau, Waiariki, Ikaroa Rāwhiti and Te Tai Tonga to combine knowledge of the diversity and resilience of indigenous and exotic tree species and how they can benefit health, housing, employment, business and recreation nationally and locally. As work on indigenous forest systems, cross-cultural methodologies and socio-economic comparisons continues, the potential for a $1 billion-plus industry and a range of novel timber products and technologies is emerging.

Climate change, and the need to mitigate its impact, is bringing communities and organisations together to tackle complex issues concerning the health of the land and its people. Scion is leading research to protect New Zealand's iconic forest landscapes, using governance methods put forward by Māori that move beyond consultation and into policy-focused stakeholder partnerships.

Through the Treaty process, iwi have transferred a rich assortment of Māori methods, inter-generational views, and land management practices that are positively contributing to GDP, ecosystem adaptation and resilience, human health, social well-being and innovation.

As Scion's experience in partnering with Māori grows, our science will be enriched by realising the full potential, creativity and enterprising nature of the people-of-the-land as the 'carvers' who will bring the wood to life.

New Zealand forests are where our nation needs to look to shape a sustainable future that responds to global and domestic drivers for economic, environmental and social change. Forest industry strategies and action plans also align with many global and local challenges and trends.

The sectors we serve

Forest industry

Annually, the New Zealand forest industry provides about $12 billion of outputs with export earnings averaging between $5 and 6 billion.

Radiata pine (*Pinus radiata*) is the predominant species comprising about 90 per cent of commercial plantings. It produces a pale yellow, medium-density timber with good stiffness and strength. A non-durable species, radiata pine can be chemically, thermally and mechanically altered to take on properties such as durability. Such versatility makes it suitable for a wide variety of structural and appearance uses. Also, radiata pine is successfully used in engineered wood applications like medium density fibreboard. After nearly 100 years of breeding, this species can be grown to maturity in about 30 years, a relatively fast rotation age internationally for a softwood. It is typically grown in large plantations of even-aged trees.

Other species, both exotic and indigenous, are attracting interest for very high-value applications based on desired features like appearance, very high stiffness and natural durability. Much of this interest comes from more recent players in the industry, such as farmers, regional councils and Māori, who recognise the ecosystem benefits (such as land protection) and the potential to create commercial outcomes.

New forest-based manufacturing industries like biofuels and chemicals are becoming mainstream. In 2012, the Wood Council of New Zealand (Woodco), whose members include the New Zealand Forest Owners Association, Wood Processors and Manufacturers Association, Logging Contractors Association and New Zealand Farm Forestry Association, acknowledged many of these opportunities in addition to growing exports of high-value timber and set an aspirational target to double export earnings from the forestry and wood processing sector to $12 billion by 2022.

New applications for wood are driven by concerns about traditional raw materials' supply, such as fossil fuels. Global production of bio-derived products is growing rapidly, and the New Zealand challenge is to de-risk these opportunities onshore and adapt them to our domestic context. Packaging is another example of a need to rapidly evolve to meet the increasing demands of modern supply chains and consumer expectations.

PHOTO: PORT OF TAURANGA

Although those who grow trees and those who manufacture products from trees tend to operate separately they have very similar and related targets. These include: minimising risk to trees from biotic and abiotic sources (pests, diseases, fire and wind), reducing cost along the supply chain and maintaining social licence to operate. The latter includes managing employees, including safety and health, treatment of the environment and traceability of all materials along the supply chain. Interest to increase onshore processing of trees within New Zealand is mutual. For growers this means limiting exposure to international log markets, and for manufacturers it means maximising capital use and having confidence to invest in plant and equipment. Domestic manufacturers have the challenges of paying for logs in the face of an international shortage of softwood fibre and adding value to those logs with products that can bear shipping costs to distant markets.

Introduction of the forest growers' levy in 2014 has boosted integration across the various tree growing groups, and this is expected to continue. The increasing influence of Māori and Māori business models is likely to further shape industry strategies over time as Māori seek to move from being landlords of forested land to being active participants in the industry itself along with a stronger focus on social well-being.

Other forest growers' strategies for radiata pine are to continue increasing biological productivity and increasing wood quality without compromising environmental impact. Forest diversification is gaining attention as participants in tree growing are changing and different markets are emerging (e.g. energy, substituting tropical hardwoods, engineered timber and planting for cultural or restoration benefits). Different models of forestry and breeding trees with different wood quality characteristics, such as a greater focus on chemical properties, are being explored.

Wood manufacturers highlight a need for long-term log supply security with logs that fit their operational models. Beneficial relationships exist between different manufacturers, for example, the by-product residues from a timber production facility will feed a pulp mill. The greater the value of those by-products then the more the manufacturer can pay for the original log.

The increasing internal focus on low carbon and housing sits well with our wood processing industry. Although the majority of New Zealand houses are wood framed, opportunity lies in penetrating the commercial and multi-storey building market and wood construction innovation.

Māori

The Crown/Māori strategy and action plan for economic development He Kai Kei Aku Ringa (2012) emphasised the importance of building meaningful science collaborations with Crown research institutes and universities, and improving the performance of Māori land and other assets.

Māori already have more than $2 billion of assets in forestry.[4] As Treaty settlements continue to conclude, Māori ownership of land, forests and geothermal assets will increase. The Māori economy is rising with land-based activities, tourism and property interests. However, challenges still remain with fragmented land ownership, remoteness from other commercial activities, accessing working capital, managing inter-generational investment and developing employment.

In spite of these challenges, the Māori economy is on the move and early indications reveal an impact on current and future models of forestry, such as increasing species diversity and focus on planting for non-timber values.

Science

In 2015, the Government released its National Statement of Science Investment (NSSI), which incorporated its 2025 vision for "a highly dynamic science system that enriches New Zealand, making a more visible and measurable contribution to our productivity and well-being through excellent science". The NSSI also focussed on all investments needing to address the twin pillars of "science excellence" and "impact".

The range of science investments is evolving. The National Science Challenges (formed in 2013) are substantial and tackle big national problems with stretchy science. Scion participates in six of these. Also substantial is the refreshed science investment approach from 2015 (the Endeavour Fund), which has two investment streams - Smart Ideas intended to "catalyse and rapidly test innovative ideas with high potential benefit to New Zealand" and Research Programmes that focus on "supporting ambitious well-defined research ideas which have credible and high potential to positively transform New Zealand's future". These are highly contested investments and are important in supporting Scion in delivering on its core purpose.

In 2017, the Ministry of Business, Innovation and Employment reshaped CRI core funding into Strategic Science Investment Platforms. These platforms focus on areas of strategic national importance to New Zealand addressing both critical outcomes for the defined area and supporting capability of national importance. Scion manages three of these platforms: Forest Systems, Manufactured Products from Trees and the infrastructure platform - the National Forestry Herbarium. These platforms are investments made for seven years and provide some stability in funding.

It is against this backdrop that Scion is fulfilling its core purpose.

The pivotal role of Scion

Scion will respond to all these drivers to deliver our core purpose in partnership with existing and emerging industry, Māori and central and local government.

Through the impact of our research and development, and our partnerships, Scion will play a key role in growing and transforming New Zealand's forest industry for a more sustainable and uniquely New Zealand way of living in a low-carbon, biobased future.

We will help develop distinctive New Zealand products, services and approaches that will enhance our nation's social, environmental and economic outcomes while also demanding a value premium around the world. We will enable opportunities for producers to develop New Zealand brands that promote a powerful 'biobased' and 'made-from-sustainably grown and managed trees' message.

We will be bold as we drive towards our 2050 aspirations for New Zealand. To do so we have identified new opportunities for investment in the forestry and related manufacturing industries.

We have defined three research impact areas to 2030 that focus where we will apply our expertise to deliver maximum impact for New Zealand.

Forests and landscapes

To grow healthy, resilient forests that are planted primarily for their standing-forest benefits.

High-value timber manufacturing and products

To grow healthy, resilient forests that produce high-value trees for manufacture into products that capture an increasing share of the global high-end market for timber.

Biobased manufacturing and products

To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials.

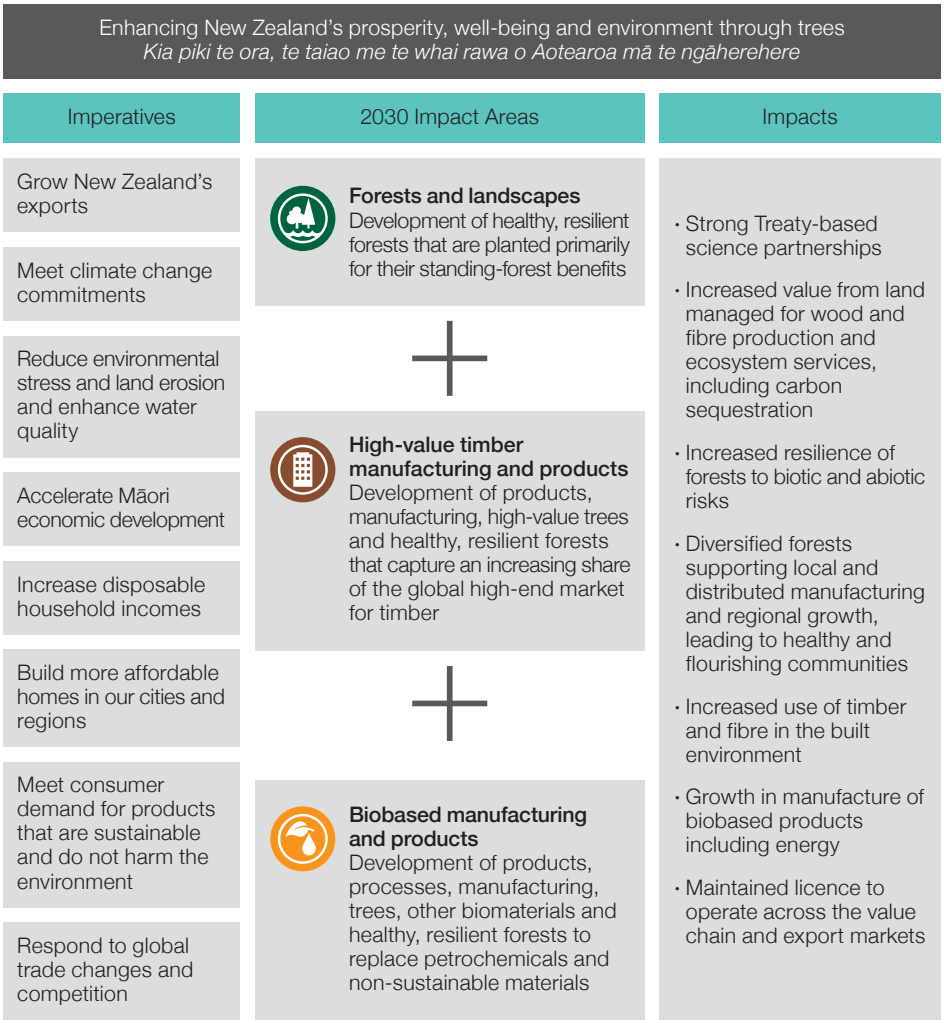
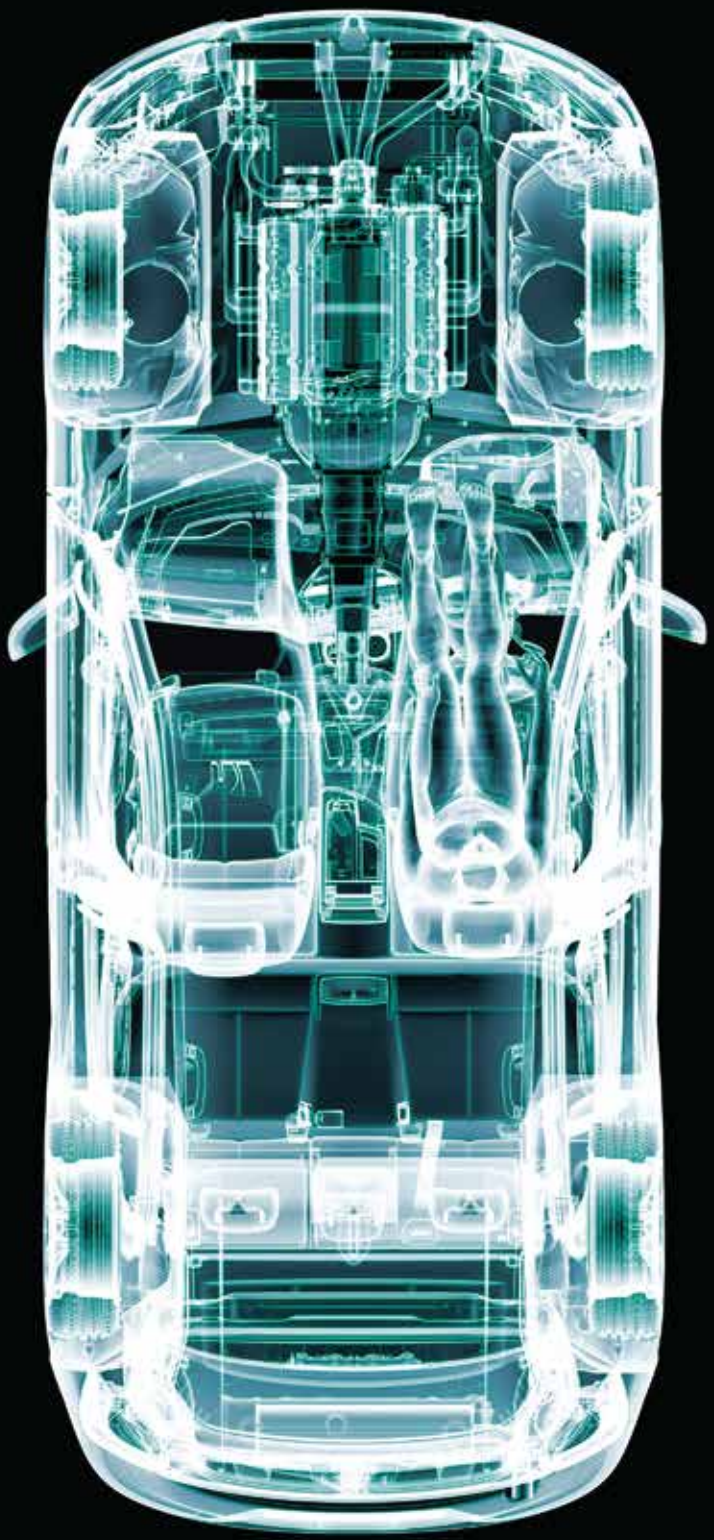


Figure 1: *From imperatives to national impacts.*

The objective to plant and grow the right tree in the right place for the right purpose underpins each of our three highly interactive impact areas. The outcomes Scion achieves will contribute to impacts that benefit New Zealand.

Each impact area spans the forest industry value chain. For each impact area, we will take a designed 'gene-to-product' value chain approach, reflecting both current and new or emerging opportunities to fast track New Zealand into increasing its standard of living while achieving its low-carbon future, government policy and industry targets.

Having delivered quality science and impact for more than 70 years gives Scion the confidence to respond to the opportunities and challenges ahead. Our strength comes from our diverse and talented staff and modern infrastructure, our broad capability in-house and across national and international collaborators and our industry and Māori partnerships. Our Treaty partners, government and industry policies and strategies will guide us in shaping our integrated research and innovation programmes to meet product targets and outcomes.



Taking a 'gene-to-product' value chain approach will see us starting with the end product, service or outcome and then determining what programmes of work across all research areas are needed to deliver for each link in the chain.

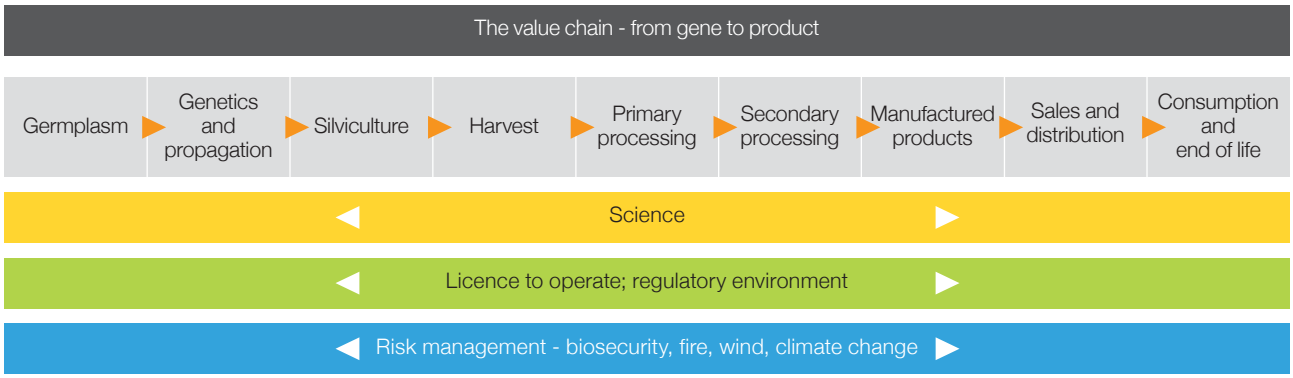


Figure 2: *The value chain – from gene to product.*

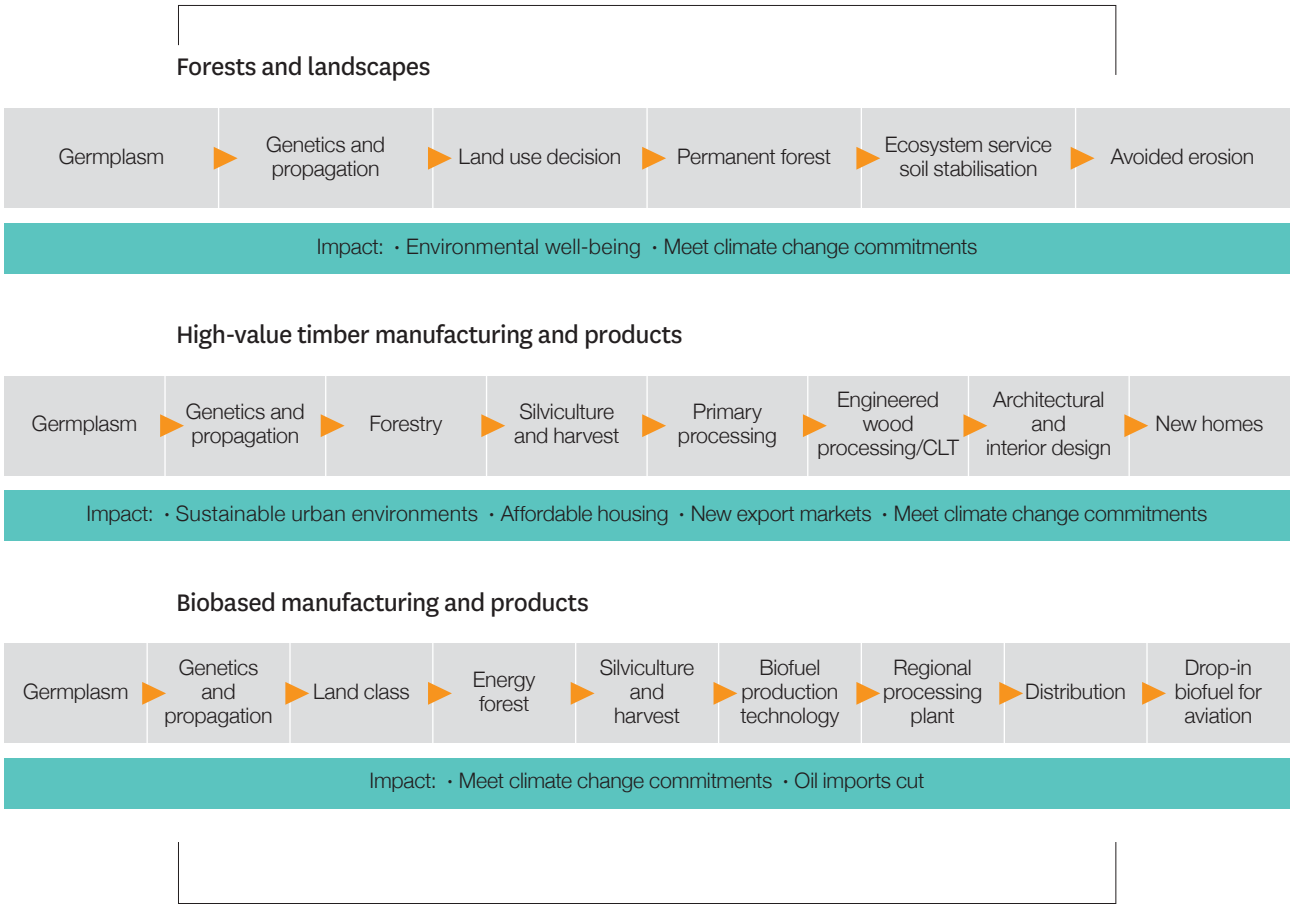


Figure 3: *Examples of the 'gene-to-product' value chain approach across the three impact areas.*

Industrial bioproducts from trees are meeting market needs.

Our expertise and reach

Scion has built a reputation as a world-leader in forest industry science and innovation. We have developed a distinct multi-disciplinary capability that spans the value chain from germplasm generation to the design and application of timber, fibre and other forest resources in commercial products and services.

These capabilities have established knowledge and technology platforms and infrastructure that are also applied to non-forest biomaterials such as in the packaging and waste sectors, the emerging bioeconomy and to broader social areas such as securing licence to operate, Māori economic development and well-being of all New Zealanders.

Our networks extend throughout New Zealand and around the world. Over many years, Scion scientists have forged strong international and national linkages with universities and other research providers with the common goal of extending scientific knowledge and developing innovative technologies to overcome some of the many and complex challenges facing today's global societies. Such collaborations keep our staff at the forefront of scientific achievement and technological advances for the benefit of the forest industry and ultimately all New Zealand.

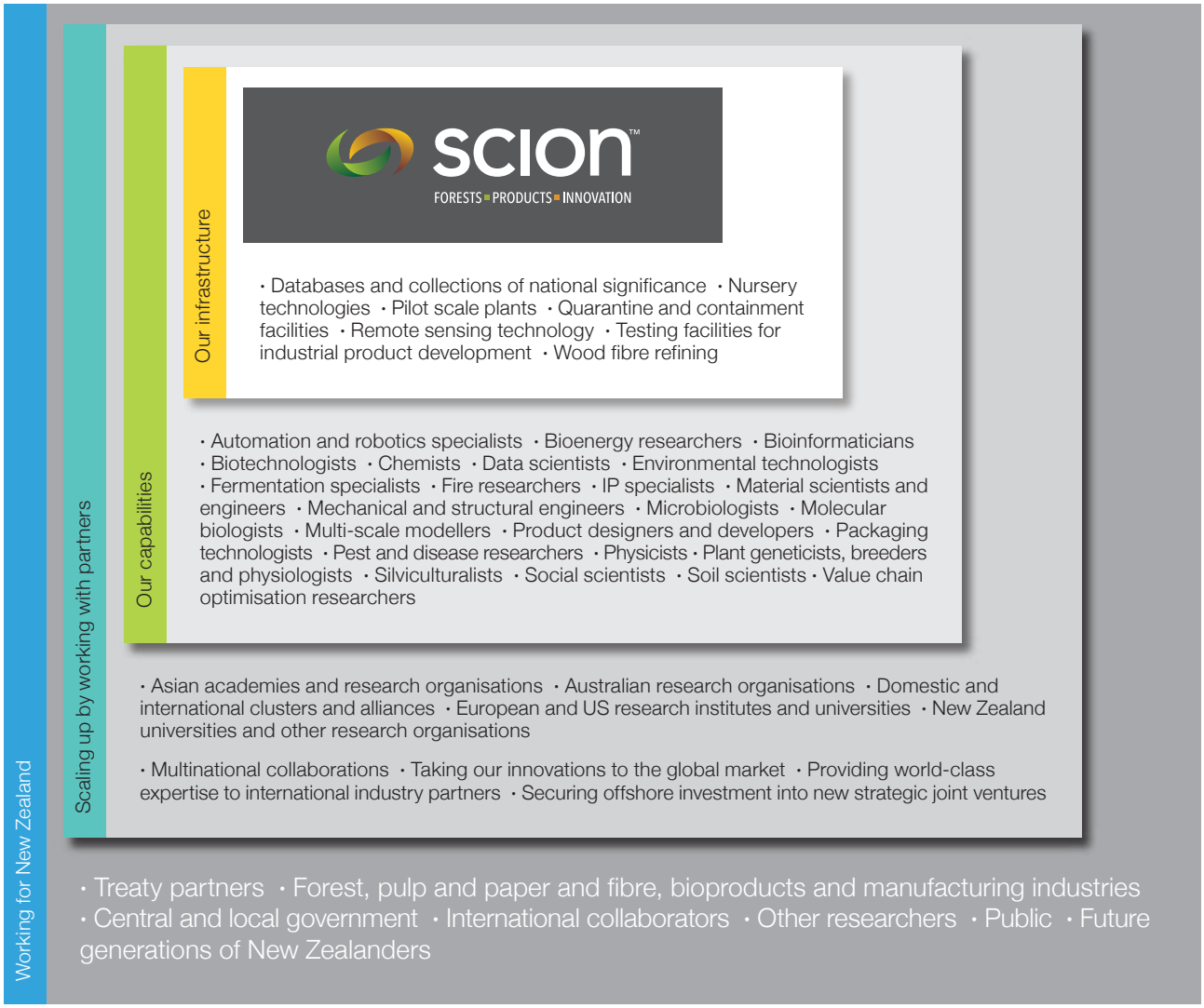


Figure 4: *Scion infrastructure, capabilities, partnerships and collaborations combine to deliver economic, environmental and social benefits for New Zealand.*

Our research impact areas

The objective to plant and grow the right tree in the right place for the right purpose underpins each of our three highly interactive research impact areas.

Forests and landscapes

To grow healthy, resilient forests that are planted primarily for their standing-forest benefits.

These forests (exotic and indigenous) are those planted primarily for standing-forest benefits such as providing ecosystem services, for example carbon sequestration (storage of carbon through photosynthetic capture and storage by trees and other plants/microbes supported by forest environments), carbon accounting, biodiversity (niches for endangered species), erosion and flood control and enhanced water quality.

Forests are treasured by people for the well-being they offer at many levels. Forests provide a sense of place where people can connect to nature, express cultural, heritage and spiritual values, recreate and relax.

Such attributes of forests only recently have become a focus of monetisation and policy interests as an under-recognised value to New Zealand.

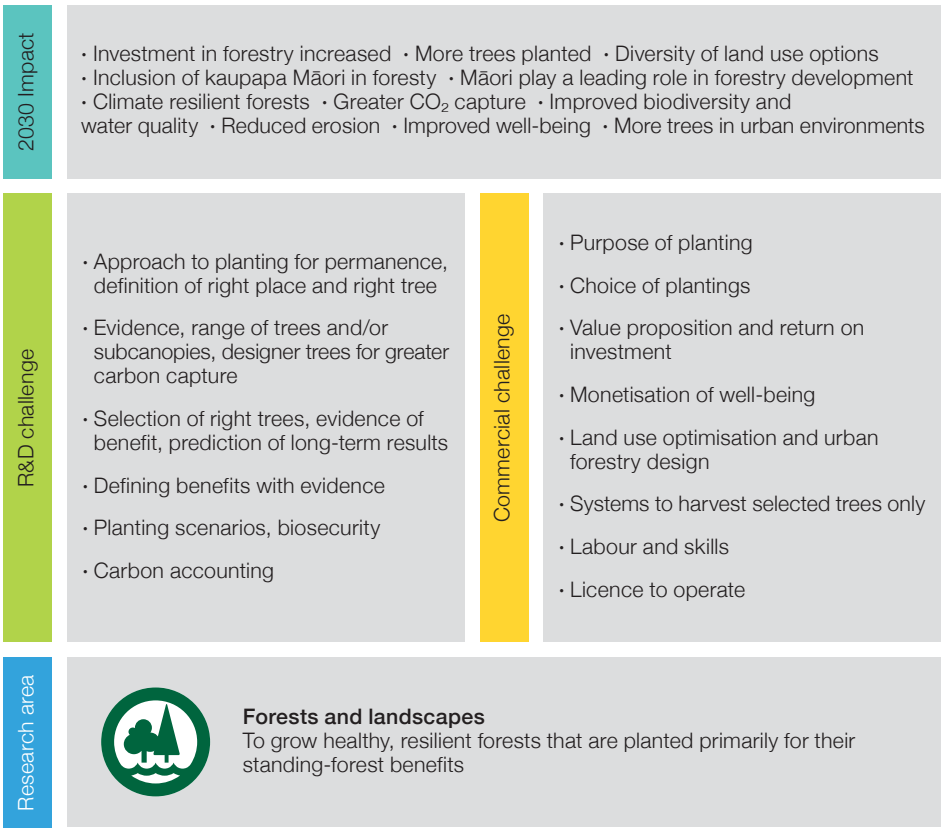


Figure 5: *Research Impact Area 1 – Forests and landscapes.*

High-value timber manufacturing and products

To grow healthy, resilient forests that produce high-value trees for manufacture into products that capture an increasing share of the global high-end market for timber.

New Zealand's dominant timber species radiata pine (*Pinus radiata*) is an introduced species and has been primarily bred to increase its biological productivity and improve timber and fibre properties and tree health. Management regimes produce a tree with many product applications in what would be regarded internationally as relatively short rotations of less than 30 years.

Radiata pine's greatest strength lies in its medium density qualities, neutral colour, good fibre properties and most importantly its ability to be engineered for some of the most demanding applications. The rapid expansion of this species through New Zealand is a result of its tolerance for diverse growth environments. It is generally planted as genetically diverse populations, rather than clonal plantings of one genotype.

Other species, such as Douglas-fir, eucalypts and indigenous species like tōtara, miro and tawa, have an opportunity to substantially increase their contribution to growing our high-value timber production base for domestic and international markets.

Successful application of current and new forest models producing products for urban applications has the potential to add an extra $10 billion to New Zealand's GDP by 2030. In particular, this is made up of $7 billion in new housing builds and engineered timber applications, 50 per cent increase in new species commercial plantings, harvests and high-value applications, increased exports of processed timber and substitution for imported timber and products.

By 2030, a reduction of 2.5 million tonnes CO_2-e per annum is possible with 1.5 million tonnes increase in CO_2 capture per annum by faster growing trees and greater timber usage in urban buildings.

2030 Impact

· Investment in forest industry increased · More trees planted · Thriving local industries for unique New Zealand timber products · Increased Māori investment and leadership across the sector · Greater CO_2 capture · More value extracted from logs processed in New Zealand · Safer working environments in forests · More carbon locked up in New Zealand urban environments · Improved standards and standards adherence · Improved quality urban housing · Better earthquake resistance · Human health benefits · Altered balance of payments, more jobs · New Zealand contribution to UN Sustainable Development Goals · Renewed infrastructure · Improved renewability of energy systems · Access to high-value markets · Public demanding wood first · Improved well-being

R&D challenge

- Benefits and performance of radiata pine versus other species
- Wood products from indigenous species
- Growing for timber quality and quantity, breeding, genetics, biotechnology, right tree in right place
- Biosecurity
- Robotics and automation and safety
- Genetics for carbon capture, keeping carbon capture in products, recycling, reuse multiple times
- Reliability of timber and materials, consistency of timber and materials, cloning and growth of trees for consistency, improved post-harvest efficiencies
- Manufacturing components invented as biobased substitutions (e.g. glues, preservatives)
- Defining and meeting standards
- Precision forestry, sensor technologies
- Engineered products (e.g. fastenings, timber and panels, acoustics, fire retardance)
- New designs: buildings and vertical villages
- Modification of radiata pine for performance as timber, modifications to radiata pine to remove components in current value chain, knowledge-embedded products
- Distributed infrastructure technologies
- Recycling of materials

Commercial challenge

- Type of investment, offshore investors with long time frames
- Which species, GM opportunities, wait for return
- Robotics and automation
- Standards development and compliance
- Balancing harvest versus planting and time frames
- Offsite manufactured housing
- Renewable materials in interior fitouts
- Furniture
- Tall timber buildings
- Reduction in import of high-value tropical and other timbers
- Changes to a centralised approach, different business models
- More responsive, adaptable and connected value chains
- Industry/Māori partnering
- Labour and skills
- Licence to operate

Research area

High-value timber manufacturing and products
To grow healthy, resilient forests that produce high-value trees for manufacture into products that capture an increasing share of the global high-end market for timber

Figure 6: *Research Impact Area 2 – High-value timber manufacturing and products.*

Biobased manufacturing and products

To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials.

Trees are living factories and can be processed into useful products including timber, biofuels, biochemicals, wood pellets, pulp and paper, fibres and biocomposites. 'Designing' trees to provide specific materials that can be used for new products, as well as modifying the way forests are planted and grown for fibre and new bioeconomy and circular economy value chains, can lead to a whole range of new products from our forestry industries. New Zealand has the opportunity to create higher added value from planted forests, and earlier returns on investment, leading to greater income for both cities and regions.

Biobased products can displace many oil-derived products and therefore make a major contribution to our low-carbon economy as well as advancing knowledge that will enable export industry growth.

Valuing trees as factories of multiple and sustainable products will change the paradigm for forestry in New Zealand. Not only does this concept accelerate New Zealand's desire to build a low-carbon economy, such as through generating fuels from trees, it also complements the production of timber because it creates high-value uses from the non-timber products. Taken further, it will lead to development of different forestry models where trees may be grown for chemicals, fibre or energy and in very short rotations. Distributed processing associated with these new concepts will bring new wealth to the regions.

By supplying new biobased solutions New Zealand can become an early adopter of the global bioeconomy approach and demonstrate a low-carbon economy. This includes sustainable packaging solutions for all New Zealand exports and local products, clever new distributed manufacturing opportunities and brand-led, new low-carbon offerings.

The potential is to create by 2030 an extra $20 billion to New Zealand's GDP, including $2 billion in fuel and plastics substitutions (imports) and $6 billion in exports. This growth will come from an emerging biorefinery sector producing biochemicals and energy products, new fibre-based materials, new cropping forests and manufacturing processes, as well as several hundred jobs in the regions and 10 million tonne contribution in reduction in CO_2-e.

Anything you can make from fossil fuels today, you can make from trees tomorrow.

2030 Impact

· New export markets · Low carbon economy · Regional development · New industries, new products, new investments · More trees planted for short time frames · Greater CO_2 capture · Climate resilient forests · Growth of New Zealand packaging businesses · Avoidance of non tariff barriers · Energy security, reduced GHG emissions · Growth of tourism · Oil imports reduced · Waste reduction · Import substitution · Forestry enabling the circular and bioeconomies · Improved well-being

R&D challenge

- Using fibres for new applications, defining market opportunities
- Extracting and using polymers and chemicals for new applications
- Distributed manufacturing solutions using trees as a resource
- Designer trees for very short rotation forests, novel extraction technologies, new applications for biobased polymers (lignin), use of fibres as biorefinery feedstocks, biosecurity
- Biobased packaging with designed end of life and compliance with new standards
- Manufacture of new bioplastics and substitution in packaging applications
- Development of tracking and printing technologies
- Bioenergy solutions for industrial heat, and transportation (air, sea)
- Design, genetics, management, harvest of forests to supply bioenergy plants, new fuel supply options/challenges
- Forest genetics, management, harvest and processing for fibre applications for today's needs (pulp and paper, panelboards) and future needs (fibre reinforcement of new products, cellulose extraction, lignin and hemicellulose needs, bark extractants), robotics and automation
- Designed biobased products for end of life and reduced carbon footprints

Commercial challenge

- New business value chains
- Value proposition
- Risk taking
- International competition
- Uptake of new technology, new business models
- New skills, new markets
- Cross sectoral issues
- Different ways to grow forests
- Different forest purposes
- Changing materials and imports of materials, new manufacturing opportunities
- New risky investments
- Radical approach
- Labour and skills
- Licence to operate

Research area

Biobased manufacturing and products
To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials

Figure 7: *Research Impact Area 3 – Biobased manufacturing and products.*

The right trees, in the right places, for the right purposes, from permanent forests stabilising land and capturing carbon, to forests for manufacture of high-value products, through to short-rotation energy forests.

Notes on page 50

Statement of Corporate Intent 2018 - 2023

Our Mission

Enhancing New Zealand's prosperity, well-being and environment through trees

Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere

Profile

New Zealand Forest Research Institute Limited	Trading as Scion
Ownership	Crown owned entity (established under the Crown Research Institutes Act 1992).
Head Office	49 Sala Street, Rotorua
Postal Address	Private Bag 3020, Rotorua 3046
Web Address	www.scionresearch.com
Governance	Shareholder-appointed Board: Chair, Tony Nowell (2010); Directors Greg Mann (2017), Barry O'Neil (2012), Colleen Neville (2014), Stana Pezic (2017), Jon Ryder (2016), Steve Wilson (2016).
Executive Management	Chief Executive, Julian Elder; General Manager People, Culture and Safety, Adriana Botha; General Manager Research and Investments, Russell Burton; General Manager Marketing and Partnerships, Arron Judson; General Manager Manufacturing and Bioproducts, Elspeth MacRae; General Manager Forest Science, vacant; Chief Financial Officer and Company Secretary, Rob Trass.
Staff	322 full-time-equivalent staff at five sites: Rotorua (289), Christchurch (30), Wellington (1), Dunedin (1), Tasmania (1) as at 31 May 2018.
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	Ingenuity, Collaboration, Excellence, Manaakitanga.
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.
Shareholder Funds	Total book value of $38.717 million at 30 June 2017.

Shareholdings

Company	Company type	Scion shareholding %
Te Papa Tipu Properties Limited	A land holding subsidiary	100.00
Biopolymer Network Limited	An incorporated joint venture	33.30
WQI Limited (T/a Solid Wood Innovation)	An MBIE-industry partnership in wood processing. WQI Limited is in voluntary liquidation and is not trading	5.05
Terax Limited Partnership	A limited partnership to commercialise the Terax technology	50.00
Terax (2013) Limited	The General Partner in Terax Limited Partnership	50.00
Sala Street Holdings Limited	Holds Scion's 50% share in both Terax (2013) Limited and Terax Limited Partnership	100.00

Delivering on core purpose to 2023

Scion's Statement of Core Purpose was adopted in 2010 by the New Zealand Government. It defines Scion's 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 beneficial environmental and social outcomes for New Zealand". 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.

A rich legacy of achievements and adaption to keep at the leading edge of change has built Scion's reputation for science and delivering impact. Our focus is to continue to build on these foundations. Specifically to: build powerful co-innovation partnerships with industry, Māori, government and with national and international science organisations to build the best teams and access new ideas, create a modern research workplace and an environment to nurture innovation in close association with our sector and research partners, growing our people and creating an environment that will attract the best people in science and innovation. Critical to the above is creating a revenue and investment base that will enable implementation of our strategy.

Scion's strategy is summarised in the balanced scorecard approach in Figure 8.

Under our strategic plan we recognise large opportunities for New Zealand. This Statement of Corporate Intent does not include the additional initiatives for Scion to increase its contribution to driving innovation and growth so that those opportunities are realised. These additional initiatives are in discussion with government.

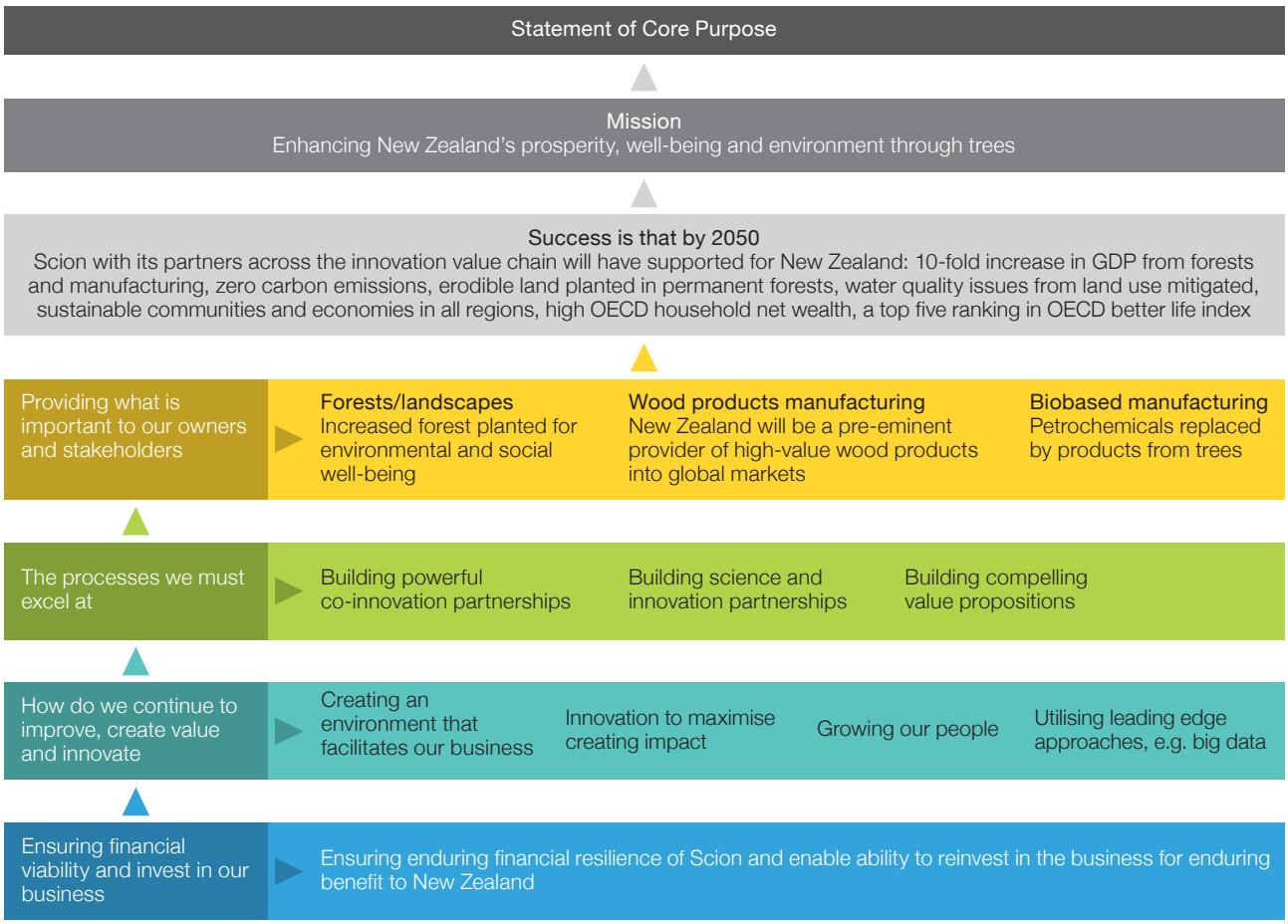


Figure 8: *Scion's strategy mapped in a balanced scorecard format.*

Impact Area 1: Forests and landscapes

Goal: To grow healthy, resilient forests that are planted primarily for their standing-forest benefits.
Funded by: 4% of total revenue.

Critical issues	Activities	Outputs that Scion will deliver	Outcomes (1-5 years)	Impacts delivered by our partners	
				Medium-term (~10 yrs)	Long-term (~20 yrs)
Mātauranga Māori is not being widely used for conservation of at-risk species or for creating forests to deliver specific ecosystem services. Creating a clear value proposition for Māori, regional authorities and other land owners to invest in forests planted primarily to provide ecosystem services. Assurance as to what species to plant and where to optimise delivery of a wide range of ecosystem services. Assurance of long-term supply of affordable and resilient planting stock. Need for new knowledge and methods for establishing and managing a range of tree species that also mitigate insecurity of labour supply. Defining management methods for quantifying and mitigating risks (biotic, abiotic, climate change) to new forest systems and that take advantage of Māori traditional knowledge	Develop Vision Mātauranga research to identify resources, people, values, histories, traditional approaches and systems that can be used to quantify ecosystem services including the cultural value of forests, improve biosecurity measures and increase forest resilience. Develop validated methods to quantify the value of ecosystem services and evaluate potential monetisation methods/policies. Develop land-use frameworks to enable optimisation of forests with other land-use options at landscape scales. Understand the interactions between trees, forests, their environments and people. Develop new forest systems for a range of tree species, including propagation methods, genetics, establishment practices, silviculture and under cropping, to assure creation of resilient forests that deliver sustainable value. Develop tools and systems to enable risk quantification and mitigation to diverse forests, including Vision Mātauranga research to identify resources, people, values, histories, traditional approaches and systems that can be used to quantify ecosystem services, improve biosecurity measures and increase forest resilience.	Partnership models and frameworks for Māori that incorporate collaboration with government and industry to achieve immediate, mid-term and long-term returns and holistic benefits from land and forestry. Science plan to underpin the one billion trees initiative to ensure the right tree (exotic and indigenous) is planted in the right place for the right purpose. New or improved spatial modelling tools that quantify delivery of ecosystem services from a range of tree species and forest management systems that incorporate Māori traditional knowledge. Integration of forestry models with other land use modelling systems. Breeding plan for at least one indigenous forest species co-developed in partnership with Māori. Best practice recommendations for tree propagation, establishment and silviculture to optimise delivery of high-priority ecosystem services. Risk modelling tools and management tools that incorporate traditional Māori knowledge. Methods to ensure choice of 'right species' takes account of risks and opportunities from forecast climate change.	Test framework implemented in key regions – Northland and Eastern Bay of Plenty and East Coast. Land use modelling frameworks. Framework deployed at a national level leading to realised benefits. Enhanced modelling tools and new knowledge have been applied by regional councils and land owners, supporting increased tree planting and ensuring the right trees are in the right place for the right purpose. Improved delivery of ecosystem services: reduced erosion, increased biodiversity, New Zealand meets carbon sequestration targets from COP21 Paris Climate Agreement. More resilient ecosystems, better service delivery and increased engagement. New seed collection and planting stock for forest restoration projects.	Māori play a leading role in forestry development. Tree planting targets met including increased area of healthy forests established primarily for non-production purposes. Improved well-being derived from afforested lands and more trees in urban environments for all New Zealanders. Regions stronger and more resilient, e.g. through increased tourism. Land use change to forestry and increased landscape diversity provides optimised delivery of targeted ecosystem services such enhanced CO_2 sequestration, reduced erosion, cleaner water and enhanced indigenous biodiversity.	

Table 1: *Impact Area 1.*

IA1 Impact statement

By 2030, Scion has provided technologies, tools and knowledge to support the establishment of planted forests (including indigenous) that will contribute to the Government's aspirations to plant one billion trees over 10 years. Forests offer a range of functions to society. Forests provide ecosystem services such as carbon sequestration, biodiversity (provision of niches for a diverse range of species), water quality improvements (riparian zones, erosion control, flood control and nutrient capture); they improve human well-being supporting health, recreational and livelihood opportunities; and intergenerational perspectives (identity and cultural values).

Key performance indicators are:

- By 2019, Scion, in conjunction with key industry, government and Māori, has developed an R&D programme that underpins the one billion trees initiative to ensure the right tree (exotic and indigenous) is planted in the right place for the right purpose, including: fit-for-purpose forest systems; accelerating propagation; forest establishment and silvicultural regimes; growth modelling; resilience to biotic and abiotic stresses; economic returns (e.g. from payments for ecosystem services, under-cropping or selective harvesting) and social acceptance.
- By 2019, Scion has developed a national ecosystem services-based investment framework for forests and an associated implementation plan that considers links to other national ecosystem services' modelling systems.
- By 2020, working with Māori entities, cultural values have been integrated with Forest Investment Framework output to make land use decisions.
- By 2020, Scion has co-developed, in partnership with Māori, a Māori Forestry Roadmap and this is formally acknowledged by government.
- By 2021, Scion continues to be recognised as having contributed to New Zealand's ongoing national and international carbon reporting obligations.
- By 2021, Scion, in partnership with Māori, has co-developed a breeding plan for at least one indigenous forest species.
- By 2023, the Forest Investment Framework has been implemented to span three dimensions (time, space and risk), integrated with other land use models, and includes at least three new ecosystem services and five new forest productivity surfaces. The framework includes a protocol to integrate Māori cultural values in the decision-making process.

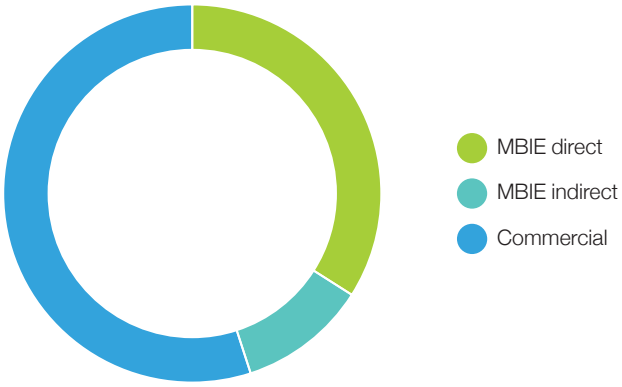


Figure 9: *Impact Area 1 by revenue type.*

Impact Area 2: High-value timber manufacturing and products

Goal: To grow healthy, resilient forests that produce high-value trees for manufacture into products that capture an increasing share of the global high-end market for timber.

Funded by: 64% of total revenue.

Critical issues	Activities	Outputs that Scion will deliver	Outcomes (1-5 years)	Impacts delivered by our partners	
				Medium-term (~10 yrs)	Long-term (~20 yrs)
Sustainable timber products, processing and timber modifications that improve product and environmental performance and New Zealand's emerging indigenous and exotic species resulting in higher earning future-proofed products. New Zealand needs innovative, affordable and flexible housing and infrastructure solutions to deal with urban intensification, decentralisation and cities operating under circular economies. Forest growing must be profitable to encourage tree planting and replanting. Agricultural land prices out of proportion to productive capacity and poor accounting for externalities and environmental impacts of different land uses. To encourage investment into processing infrastructure there needs to be confidence in the long-term supply of logs that meet minimum quality standards and market demand (local and international). Lack of access to affordable and	New fundamental timber properties explored at micro and macro levels. New timber modification and processing techniques through improved automation, robotics etc, including small-scale options. New panel/board solutions for interiors. Decentralised waste options investigated. Prefabrication and production technologies focusing on manufacture and design for sustainability, whole of life, urban farming/ forests, occupant health and affordability. New building acoustic products. Retrofit options to improve occupant health. Improve forest productivity, wood quality attributes, stock uniformity, and operational efficiency through a range of advanced breeding technologies including biotech approaches, optimised silvicultural systems, application of precision forestry concepts, and new automation systems. Develop validated	Two sustainable timber products with robust business cases ready for commercialisation. Viable processing options for four emerging species. Tested market 'pull' product attributes. New acoustic solutions for multi residential (3-7 storey) timber structures. Carbon storage in timber structures is quantified and recognised in standards. Revised New Zealand building and timber standards. Localised infrastructure design. Working with a range of stakeholders (public and industry) to help facilitate the development of offsite manufactured prefab housing model for New Zealand. More rapid delivery of improved planting stock (growth, quality, health traits), new knowledge on optimising for right tree, right place, right purpose, improved genetics, silvicultural models and management methods, and demonstration of automation concepts.	Demonstration at pilot scale – two new technologies and products. Successful retrofit of old buildings with improved performance. New multi-storey building design choices with products supporting improved GHG emissions and acoustic performance. Investment in forestry increased, and increased area planted for production of timber suitable for high-value products. Maintenance of licence to operate and regional and national policies that recognise benefits from delivery of ecosystem services. Premium prices/ access to more high-value markets from certified sustainably produced timber. Biotechnology accepted for production of trees in new forests. Increased meaningful participation by Māori in the forest industry, employment and training. Increased number of Māori forest students, graduates, interns and researchers.	Product in commercial production. Embedded improved acoustic materials and infrastructure trialled in one multi-storey building. Significant portion of homes are manufactured by modern offsite factory systems. First exports of New Zealand designed affordable homes with beneficial sustainability criteria. Increased volume and diversity of exports. Better market access. One billion trees planted and best land-use practices implemented. Under-utilised Māori land transitioned into productive use. Increased diversity of the planted forest estate mitigating biosecurity and market access risks.	Export sales of new modified timber product(s). Higher value per cubic metre of timber. Improved value from uniquely New Zealand products. New exports of engineered timber and offsite construction prefab housing. Preferred choice for tall buildings is timber (wood-first). Healthier homes. New forests supporting high-value wood. Products from a range of tree species. New Zealand meets greenhouse gas emission targets. Increased GDP, increased employment. Through participation a 10-fold increase to Māori forestry GDP = increased jobs, healthy forestry communities, strong investments and returns.

resilient planting stock and lack of knowledge of appropriate establishment and silvicultural methods, productivity and performance for niche tree species/ products (e.g. tōtara). Investors in forest growing require confidence that biotic and abiotic risks including climate change are appropriately identified, quantified and mitigated. Māori have high aspirations in forestry but there are structural and land ownership complexities. Low level of inclusion of kaupapa Māori in forestry and industry alignment to their objectives.	methods and models to quantify value of ecosystem services and monetisation methods/policies, and develop and verify sustainable forest management practices. Understand market demand and product performance requirements (i.e. aligning materials, species to markets). Link back to models at a range of scales to ensure functional value chains and critical mass of raw materials for viable processing. Evaluate cooperative forest models to integrate supply across many small-scale growers. Develop industrial-scale propagation methods and new knowledge, including Mātauranga Māori, on establishment and management of diverse forest species on different site types. Develop tools and methods to quantify biotic and abiotic risks, including climate change and mitigation methods, for a range of species, sites and silvicultural regimes. Facilitate increased collaboration between industry, training/education/ research, iwi and government to optimise the Māori contribution to forestry. Iwi and Industry Forestry Group founded on mutual benefits go on to facilitate iwi-industry knowledge transfer through workshops and collaboration.	Spatial modelling tools are available for quantifying a range of ecosystem services and environmentally sensitive/sustainable management practices. Deliver reports on market demand for specific products. Integrated modelling tools and recommendations for ensuring viable forest value chains at a regional scale. Recommendations on cooperative models. Best practice recommendations for tree propagation, establishment and silviculture/growth models to optimise productivity and wood quality traits and delivery of high-priority ecosystem services. Risk layers incorporated into spatial modelling tools, and treatment recommendations for managing risks. Ensuring choice of right species and genetics takes account of risks and opportunities from forecast climate change. Increased use of Māori knowledge in the forestry industry. Working with Māori developing new vertically integrated high-value wood manufacturing business models.	Iwi are confidently increasing investment in forestry. Iwi and industry partnerships have formed through the value chain. Increased uptake of forest research by iwi. Scion has helped to meet the Crown's Treaty partnership in forestry, science, economic development, education and health.		

Table 2: *Impact Area 2.*

IA2 Impact statement

By 2030, Scion has supported the industry to at least triple its production of high-value timber products (over 2018 level) and the growth and competitiveness of the commercial forestry estates.

This support has contributed to regional economic development, and social and environmental equity by growing the diversity of wood products, modifying timber characteristics to maximise the range of high-end product uses, developing novel localised infrastructure solutions for buildings and supporting expanding use of timber into buildings, including tall buildings.

In addition, Scion has developed new genetics, tools and technology (e.g. automation, robotics, sensors), diversified the range of species grown and processed, including indigenous, to provide surety of supply to processors and encouraged investment along the forest-to-consumer value chain including new processing options designed to fit a nation where forest resource is dispersed.

The industry will be operating in an environment where biotic, abiotic and climate change risks are managed.

Key performance indicators are:

- By 2019, Scion has delivered a genotyping technology (e.g. SNP Chip) to the Radiata Pine Breeding Company that will initiate the inclusion of genomics into breeding programmes.
- By 2019, the full value of planted forests, including key ecosystem services will have been communicated to forest managers, regional and central government agencies at the National Forest Ecosystem Services Forum.
- By 2019, the key outcomes from the multi-year GCFF programme (i.e. new knowledge on optimising right tree, right place, right purpose, improved genetics, silvicultural models and management methods) will have been communicated at national industry events to large-scale forest owners and the many small-scale Farm Forestry Association members.
- By 2019, options to reduce the impact of *Phytophthora* on radiata pine, kauri or one horticultural species have been identified and one option has been adopted.
- By 2019, Scion has progressed a novel wood modification process that shows improved durability, stability performance along with new colour options on radiata pine to pilot scale and has completed a commercialisation strategy.
- By 2020, an integrated land use framework including timber and non-timber values has been proved and used in validating forestry investments under the billion trees initiative.
- By 2020, Scion has worked with Māori, and at least one Māori entity is active in building a new vertically integrated high-value wood manufacturing enterprise.
- By 2021, Scion, with science collaborators, government, and industry partners with non-traditional urban stakeholders, has developed a platform of high-value wood products to provide better performing, higher amenity built-environments in terms of affordability, performance and sustainability, e.g. tall timber buildings, prefabrication etc.
- By 2023, Scion has provided the underpinning science to support and enhance licence to operate through environmental certification and to meet regulatory requirements, particularly in relation to Douglas-fir wilding spread and pesticides use.
- By 2023, 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 MAI from an average of 20 m^3 ha^{-1} yr to 35 m^3 ha^{-1} yr and in a way that enhances the sustainability of forest growing in New Zealand.
- By 2023, the forestry industry, land owners, and central and regional government have adopted new tools, approaches and technologies developed to mitigate impacts from the increasing risk to New Zealand's forests from pests (insects, pathogens, weeds), fire and wind in our changing environment (climate, trade and tourism), and to mitigate risks and take advantages of opportunities from climate change.
- By 2023, the improved Forest Investment Framework has been used by at least five regional councils, forestry companies and Māori entities to develop landscape-level plans for new forests targeting high-value wood products as well as other ecosystem services.
- By 2023, Scion has provided tools, new biotech and genetic solutions, new plant material (e.g. germplasm) and competitive niche wood products that will increase the confidence of growers of Douglas-fir, eucalypts, cypresses, redwoods and indigenous species to increase plantings of these species by at least 50% over 2018 plantings.
- Ongoing: New technologies such as automation, robotics, sensors, new digital technology have been implemented in the cities/buildings/products/processing and forest growing value chains, demonstrating improved efficiency, cost reduction, improved safety, and better living and working environments.
- Ongoing: Support forest growing, wood products and building industries to grow and develop by addressing domestic/international standards, regulations and market specifications.

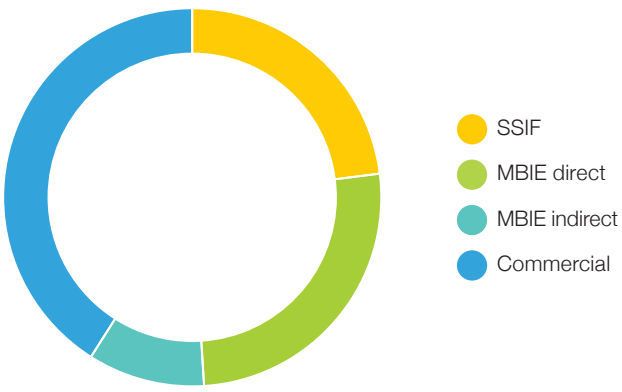


Figure 10: *Impact Area by 2 revenue type.*

Impact Area 3: Biobased manufacturing and products

Goal: To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials.

Funded by: 32% of total revenue.

Critical issues	Activities	Outputs that Scion will deliver	Outcomes (1-5 years)	Impacts delivered by our partners	
				Medium-term (~10 yrs)	Long-term (~20 yrs)
Provision of sufficient raw fibre for current and future pulp and paper production including development of new added value fibres and fibre composites. Alternative bioenergy supply to offset petroleum imports to New Zealand and reduce New Zealand GHG emissions. Designing new forest systems and germplasm for bioenergy, biofibre or biochemical raw material supply. Enabling New Zealand to sell products internationally and avoid non-tariff barriers through new packaging solutions. Developing robotic and automated technologies throughout the fibre and biochemical/ bioenergy supply chain. Adding value to bark as an option to debark logs prior to processing - creating more value from a single log. Appropriateness of and compliance with new standards and revised established standards.	Fibre science (structures, chemistry, extraction, genetic variation). Germplasm screening and genotype characterisation. Biotic challenges and management choices in producing short-rotation close planted forests. Bioenergy processing from harvest to energy product for consumer use. Biotechnological approaches to engineering trees and microbes for new bioproduct applications. Creating awareness across the entire value chain of the impact of bioeconomy principles in the New Zealand context. Development of new bioplastics and 3D/ 4D printing and packaging products. Green electronics and printing technology development. Lignin and hemicellulose modification and application in new biobased products using end-of-life design thinking. *Overleaf*	Genotypes appropriate for growing future fibre forests for pulp and paper applications proven. Generation 3 fibre plastic composite prototypes. Solid and liquid bioenergy solutions (e.g. torrefied, briquettes, marine biodiesel) demonstrated at pilot scale. New biodegradable materials and products based on verifiable evidence for company uptake. New mobile extrusion processing equipment and processes able to be deployed near forests to at least partially manufacture new materials. 3D and 4D manufactured products that enable onshore processing and distributed small-scale on time production using biobased materials.	New biotech trees demonstrated benefit in improved processability of fibre. New fibre composites demonstrated that provide improved reinforcement to plastic. Alternative tree management systems to supply bioproducts established and business cases completed. New standards/ trade barriers have been overcome for packaging applications and biobased materials and products have been verified by a third party. The biodegradation facility has enabled success through verification of environmental benefit for at least three new products developed together with New Zealand companies. At least one Māori entity has included new biobased materials in their product portfolio.	Short-rotation biotech trees as 'crops' accepted by the public. New Zealand energy industry has developed a liquid biofuel production facility for marine and/or jet fuels. Consortium of parties (industry/ investors) established and operating providing end user pull resulting in first production of bioenergy from trees for transport applications. New Zealand pulp and paper mills have new product streams enabling higher profit and more effective use of fibre resources. New packaging solutions are in use with a New Zealand company. IP relating to new chemicals or fibre or plastic products has been taken up by a new commercial entity. Standards are supporting innovation in New Zealand and export growth.	New Zealand growing short-rotation forests for a range of high value add biobased product applications for export and import substitution. New Zealand maintains and grows biobased exports due to leading-edge packaging solutions that avoid non-tariff barriers and are preferred by consumers. New Zealand reduced GHG emissions through use of bioenergy replacements for industrial heat and aviation and shipping applications. Successful and vibrant communities using distributed and small-scale manufacturing close to tree resources. Biorefinery operations in at least three regions of New Zealand. At least three Māori entities have invested in a new biobased processing and manufacturing facility making new added-value products from trees.

	Creating a bark biorefinery and extracting novel polymers and biochemicals. Extraction and modification of biopolymers and formulation of products. Prototype manufacture and scale up technologies. Handling of data and analysis, chemical analysis, microscopy, non-destructive and destructive testing, modelling carbon and life cycle assessment measurements. Validated management tools. The gene-to-product value chain creating bioproducts from trees, including environmental and social benefits. Address domestic standards, traceability and environmental compliance for new bioproducts to allow international market access.				

Table 3: *Impact Area 3.*

IA3 Impact statement

By 2030, Scion has supported existing and new industries to establish biobased manufacturing capacity for export and domestic markets based on new forest biomass feedstocks. The potential is to create by 2030 an extra $20 billion to New Zealand's GDP, including $2 billion in fuel and plastics substitutions (imports) and $6 billion in exports. This growth will come from an emerging biorefinery sector producing biochemicals and energy products, new fibre-based materials, new cropping forests and manufacturing processes, as well as several hundred jobs in the regions and 10 million tonne contribution in reduction in CO_2-e.

Key performance indicators are:

- By 2019, at least six new polymeric material products with renewable content have been developed to prototype stage using existing (e.g. extrusion, injection moulding) and emerging technologies (e.g. 3D-printing or electrospinning), and two of these prototypes have been incorporated into new product offerings by firms.
- By 2019, two different genetically modified biotech trees have been evaluated to determine their viability as alternative feedstocks to produce high-value chemicals and/or processability for fibre or bioenergy.
- By 2019, Scion has identified, and reached national alignment, around the implementation of New Zealand's Biofuels Roadmap. Technology barriers, acceleration options and policy interventions have been identified. Large commercial projects have been scoped out for final definition.
- By 2020, Scion and commercial partner(s) have developed a viable and New Zealand-specific biorefinery business case including Scion-developed high-value bioproducts and cost efficient technology platforms for commodity fibres and bioenergy, including criteria for new short-rotation forest trees systems.
- By 2022, New Zealand has new industries using new high-performance products enabled by Scion-developed technologies (on-demand degradable plastics, green electronics, biobased composites, lignin products and new compounded materials containing biopolymers), using existing (e.g. extrusion, injection moulding) and emerging technologies (e.g. 3D-printing or electrospinning).
- By 2022, Scion has identified commercial opportunities that have led to drop-in replacement of coal with wood residues or wood-based solid fuel products to generate heat in industrial processes. This will help drive a 1% reduction in GHG emissions per annum from the sector, aligned with the New Zealand Energy Efficiency and Conservation Strategy target.
- By 2023, Scion and commercial partner(s) have progressed the New Zealand-specific biorefinery business case to progress this to demonstration/pilot scale.
- By 2023, Scion has demonstrated the feasibility of converting forest and other biobased materials through distributed and mobile processes into chemicals and biopolymers and has identified a group of interested industrial partners to progress one of the technologies to pilot/demonstration scale.
- By 2023, at least two new growing regimes have been established with the aim of demonstrating how to sustainably grow resilient short-rotation fibre products with either biotech trees or new germplasm with high production of fibres or chemicals.
- By 2020, Scion has worked with Māori, and at least one Māori entity has included new biobased materials in their product portfolio.
- Ongoing: Provide evaluation of benefits and risks to increase engagement and stakeholder support for biotech for forestry and other bioproduct industries.
- Ongoing: Support bioproducts and bioenergy industries to grow and develop by (a) addressing standards that create artificial barriers to products accessing markets or applications, (b) developing technologies and IT systems that allow bioproducts to be traced within the value chains they are transacted in and for their source to be verified, and (c) ensuring environmental compliance for regulators and customers.
- Ongoing: Support industry to meet environmental and social compliance for regulators and customers, and ensure quantified outcomes for biotechnology applications are presented to the forest industry, government and other key stakeholders to facilitate an informed decision on future implementation.
- Ongoing: Creating awareness across the entire value chain on the impact from bioeconomy principles in the New Zealand context.
- Ongoing: Quantify risk profiles and mitigation methods for densely stocked forest systems, and delivery of ecosystem services (both positive and negative) for new forest systems to underpin environmental certification and sustainability credentials.

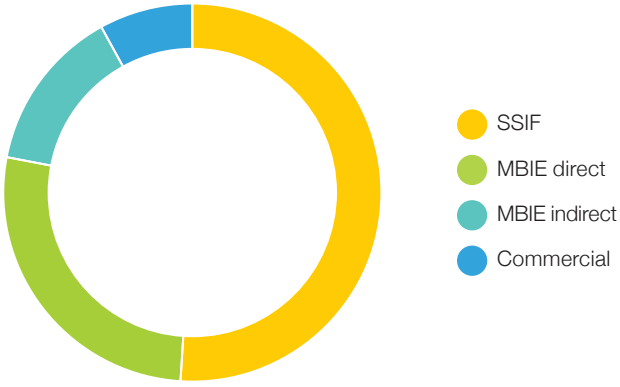


Figure 11: *Impact Area 3 by revenue type.*

Shaping Scion

The processes we must excel at

Building powerful co-innovation partnerships. Delivery of impact (more forests being planted to protect land or sequester carbon, or more exports of high-value timber or energy from trees replacing oil) can only be achieved through robust partnerships across all players along the innovation pathway adapting science to achieve a business, social or environmental outcome.

Co-innovation with all sector partners is an important aspect of this as is strengthening integration with Mātauranga Māori. Scion will continue to build on and increase the existing partnerships it has with the sector through workshops, joint planning, two-way partnerships including with iwi organisations and to extend these partnerships to key influential end-users such as in housing and transport.

Further development of the innovation hub and co-location with aligned organisations is important to building co-innovation partnerships.

Building science and innovation partnerships. Building strong national and international networks with world-leading research organisations in forestry, wood processing and biobased sectors provides significant strategic and technical opportunities to New Zealand and delivery of Scion's core purpose. Scion is conscious of the ongoing choices between invention and adaptation and the implied cost implications. Scion offers a rare international opportunity to others owing to our multi-disciplined skill set that spans the germplasm to customer value chain. Scion will continue to deepen these science partnerships including staff exchanges.

Building compelling value propositions. Scion focusses on creating impact through undertaking science of international standing and ensuring it has the best pathway to impact. Science is by nature a risky enterprise. Understanding the value that is created and minimising risk through using the best teams along the entire innovation pathway, with the best project management approach, is vital to ensure that investor interest is protected and that investment will continue. Aligned to this is regular review of Scion's investment portfolio to ensure delivery to strategy and maximisation of impact.

Continuing to improve, create value and innovate

Creating an environment that facilitates delivering our business. Creating the right environment remains an important focus for Scion. This includes continuing to invest in world-class science equipment and facilities and in particular pilot plant and the information technology systems expected of an organisation operating in the 21st century.

Collections and databases (e.g. the Permanent Sample Plot, the National Forestry Herbarium, the Forest Insect Collection) are critical to undertake science and also to protect nationally important assets.

An important feature of improving our environment to deliver on our strategy is continuing to enhance the Te Papa Tipu Innovation Park where currently we have 27 tenants. To complement the park, Scion is jointly developing an innovation hub with support from the Bay of Plenty Regional Council and Rotorua Lakes Council. This will attract more aligned businesses to come into the heart of Scion and further encourage communication and co-innovation. Our aim is to ensure that the Scion environment is open to all cultures and reinforces Scion's organisational values - Collaboration, Ingenuity, Manaakitanga and Excellence.

Innovation to maximise creating impact. Converting knowledge into outcomes requires skills in technology transfer including communication and commercialisation. Scion undertakes regular workshops with its sector partners and hui while also sustaining two-way secondments to nurture these. The Scion website and newsletters (e.g. *Scion Connections*) are important communication channels, which are regularly reviewed to enhance their effectiveness.

Commercialisation remains an important focus for Scion. Key activities this year include: Terax (reducing municipal wastes) a partnership between Scion and Rotorua Lakes Council, Woodforce (a wood-polymer) being developed with Sonae-Arauco, Ligate (a fully biobased adhesive) and a novel plant propagation system being developed with Ngati Whare.

Scion's focus over the next period is to continue to strengthen commercialisation and management of the commercialisation portfolio.

Cultivating a culture of innovation, collaboration and continuous improvement

Scion's "People, Culture and Safety (PCS) Plan 2019-2023" supports the delivery of Scion's strategic direction in line with its Statement of Corporate Intent. It is designed to ensure Scion has the right employees it needs to meet current and future business and client demands and defines how we will deliver on:

- An organisational approach (structure) and network that support the delivery of Scion's strategic objectives.

- Assessing and supporting current and future workforce capacity and capability requirements.
- Defined career pathways to enable long-term development, progression and succession planning.
- Articulating and embracing leadership and staff behaviours that support our values and promote the desired organisational culture and working experiences.
- Create an organisational orientation to Māori engagement and stakeholder management as a key capability.
- People practices (systems, policies, procedures and programmes) that ensure organisational effectiveness, consistency and positive working experiences.
- The safety and well-being of all workers engaged through Scion.

Utilising leading edge technologies. Managing extremely large data sets that are analysed computationally will shape both the sectors with which we work (e.g. managing trees within a forest) and also how we undertake science. In 10 years, science may be driven through data analysis rather than through hypothesis driven approaches. Similarly, the field of gene editing and biotechnology and 3D printing are opening up whole new approaches to undertaking science as well as creating step changes in potential outcomes. Scion is committed to ensuring we sustain active involvement in all these approaches either directly or through partnerships with other organisations.

Ensuring financial viability and ability to invest in our business

Robust and strong financial management remains at the heart of Scion. Scion secures its investment through a mix of sources including government (science and other) funding mechanisms that rely on short- (less than a year) and longer- (longest at seven years) terms, contract for service revenue, and royalty and other returns from utilisation of knowledge generated within Scion. However, undertaking science and innovation and providing nationally important capability is a long-term business hence Scion will continue to focus on building sustainable revenue sources so it can continue to provide a science and innovation business of international standing and deliver on its core purpose outcomes.

Financial performance and reinvestment

Financial projections and performance

Scion's updated financial projections through to June 2023 are summarised in Table 4. Financial performance indicators are included in Table 5. Associated consolidated cash flow and balance sheet details are presented in Tables 7 and 8.

Scion is budgeting to grow revenues by 3.9% in 2018/19 to $58.980 million and achieve an Operating Profit (EBIT-R) of $3.272 million (Table 4). This represents a 5.9% return on equity (RoE) before reinvestment. Reinvestment of $1.1 million will generate a tailored RoE of 4.0% (Table 5). Future revenues are projected to increase at between 3.5% and 5.0% annually over the planning period. Risks to achieving these financial targets are the increased contestability for science funding and the impact of significant new facility developments at Scion's Rotorua campus. In particular, Scion has $10 million of Endeavour Funding coming off contract over 2018/19 and 2019/20 that will need to be replaced. Scion has a strong pipeline of government programmes submitted and in development to support this.

Projected Statement of Financial Performance for the Five Years ended 30 June 2023

	30/06/2018 $000	30/06/2019 $000	30/06/2020 $000	30/06/2021 $000	30/06/2022 $000	30/06/2023 $000
Revenue						
SSIF	17,734	17,734	17,734	17,734	17,734	17,734
Other MBIE Revenue	15,055	15,366	16,134	16,780	17,786	18,854
Commercial and other	23,871	25,523	27,208	28,364	30,293	32,246
Royalties	119	357	714	1,071	1,339	1,673
Total revenue	56,779	58,980	61,790	63,948	67,151	70,507
Operating expenditure						
Personnel	27,268	30,468	31,513	32,276	33,909	35,624
Other operating costs	25,153	25,140	26,222	27,296	28,539	30,068
Total operating expenditure	52,421	55,607	57,735	59,572	62,448	65,692
Scion margin	**4,358**	**3,372**	**4,054**	**4,377**	**4,704**	**4,815**
Loss on disposal of fixed assets	(108)	0	0	0	0	0
Restructuring costs	(148)	(100)	(100)	(100)	(100)	(100)
EBIT-R*	**4,102**	**3,272**	**3,954**	**4,277**	**4,604**	**4,715**
Reinvestment	(1,465)	(1,100)	(1,550)	(1,650)	(1,700)	(1,800)
EBIT	**2,637**	**2,172**	**2,404**	**2,627**	**2,904**	**2,915**
Net interest income/(expense)	496	187	59	(78)	(162)	(75)
Profit before tax	**3,133**	**2,359**	**2,463**	**2,549**	**2,742**	**2,840**
Tax	(936)	(684)	(714)	(739)	(795)	(824)
Group profit after tax	**2,197**	**1,675**	**1,749**	**1,810**	**1,947**	**2,017**
Profit attributable to shareholders	**2,197**	**1,675**	**1,749**	**1,810**	**1,947**	**2,017**

**EBIT-R is EBIT before reinvestment*

Table 4: *Projected statement of financial performance for the five years ended 30 June 2023.*

Projected Financial Performance Indicators for the Five Years ended 30 June 2023						
	Forecast	Target	Target	Target	Target	Target
Efficiency:	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Operating margin	11.4%	11.5%	12.1%	12.6%	12.9%	12.5%
Operating margin per FTE	$20,627	$20,012	$22,060	$23,892	$24,871	$24,624
Risk:	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Quick ratio	2.40:1	1.39:1	0.91:1	0.90:1	0.97:1	0.99:1
Interest coverage	N/A	N/A	N/A	33.7x	17.9x	38.9x
Operating margin volatility	6.7%	6.4%	7.3%	9.9%	12.1%	10.8%
Forecasting risk	1.8%	1.0%	0.7%	0.6%	0.2%	(0.0)%
Growth/Investment:	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Adjusted before reinvestment	8.2%	5.9%	6.5%	6.5%	6.7%	6.7%
Adjusted return on equity	5.5%	4.0%	4.0%	4.0%	4.1%	4.1%
Revenue growth	10.3%	3.9%	4.8%	3.5%	5.0%	5.0%
Capital renewal	2.2x	3.2x	2.2x	1.9x	1.3x	0.7x

Table 5: *Projected financial performance indicators for the five years ended 30 June 2023.*

Reinvestment of surpluses

Reinvestment is proposed to support and accelerate the commercialisation process at Scion over the five year planning period. This strategic intent is fully consistent with the recommendations in Scion's 2015 Four Year Rolling Review and is essential for Scion to achieve impact for New Zealand from the science we do. 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.

The business case for reinvestment is reviewed by the Board as part of the annual refreshing of Scion's strategy and SCI, and preparation of the Annual Operating Plan. Investment in commercialisation initiatives are managed with the Scion Commercialisation Committee, a committee of the Scion Executive.

The financial impact of the reinvestment is summarised in Table 6.

Summary of Strategic Learning and Growth (L&G) Initiatives 2018/19 to 2022/23										
	2019		2020		2021		2022		2023	
Reinvestment projects	EBIT	RoE	EBIT	RoE	EBIT	RoE	EBIT	RoE	EBIT	RoE
L&G5 Commercialisation capability	100	(0.2%)	0	00.%	0	0.0%	0	0.0%	0	0.0%
Accelerating commercialisation	1,000	(2.4%)	1,550	(3.5%)	1,650	(3.6%)	1,700	(3.6%)	1,800	(3.6)
Total	1,100	(2.6%)	1,550	(3.6%)	1,650	(3.6%)	1,700	(3.6%)	1,800	(3.6%)
Tax	(308)	0.7%	(434)	1.0%	(462)	1.0%	(476)	1.0	(504)	1.0%
Profit impact on reinvestment	**792**	**(1.9%)**	**1,11**	**(2.5%)**	**1,188**	**(2.6%)**	**1,224**	**(2.6%)**	**1,296**	**(2.6%)**
Initial target ROE		5.9%		6.5%		6.5%		6.7%		6.7%
Revised ROE target after impact		4.0%		4.0%		4.0%		4.1%		4.1%

Table 6: *Summary of strategic reinvestment.*

Cash position, balance sheet structure and dividends

Scion is forecasting end-of-year cash balances in the range of $12.9 million (June 2018) and net debt of $3.4 million (June 2022) over the five-year planning period (Table 7). $48.0 million of capital investment has been allowed for in the five year planning period including the upgrading and expansion of Scion's building stock. This result of Scion's reinvestment of surpluses of $1.1 - $1.8 million per annum and capital renewal ($4.4 - $14.8 million per annum) means that Scion's net assets are forecast to grow by $9.2 million to $50.1 million over the planning period (Table 8).

Projected Statement of Consolidated Cash Flows for the Five Years Ended 30 June 2023

	30/06/2018 $000	30/06/2019 $000	30/06/2020 $000	30/06/2021 $000	30/06/2022 $000	30/06/2023 $000
Cashflow from Operating Activities						
Cash received from operations						
Crown	32,789	33,100	33,868	34,513	35,520	36,587
Other clients	23,824	25,733	27,771	29,282	31,475	33,761
Interest	511	187	59	(78)	(162)	(75)
Total cash received from operations	57,124	59,020	61,698	63,717	66,833	70,273
Cash disbursed on operations						
Personnel	27,937	30,486	31,529	32,290	33,921	35,635
Suppliers	22,168	21,541	22,611	23,496	25,037	25,853
Taxation	1,175	691	704	731	776	814
Total cash disbursed on operations	51,280	52,718	54,844	56,517	59,735	62,302
Projected net cashflows from operations	5,844	6,301	6,854	7,200	7,099	7,971
Cashflow from investment activities						
Purchase of investments	(125)	0	0	0	0	0
Purchase of fixed assets	(8,177)	(14,600)	(10,823)	(10,377)	(7,350)	(4,100)
Purchase of intangibles	(150)	(150)	(150)	(150)	(150)	(150)
Net cash received/(disbursed) from investing activities	(8,452)	(14,750)	(10,973)	(10,527)	(7,500)	(4,250)
Cashflow from financing activities						
Increase in term debt	0	0	0	3,100	400	0
Repayment of term debt	0	0	0	0	0	(3,500)
Total cash disbursed on financing activities	0	0	0	3,100	400	(3,500)
Net increase (decrease) in cash	(2,608)	(8,449)	(4,119)	(227)	(1)	221
Exchange rate effect	0	0	0	0	0	0
Opening cash balance	15,517	12,909	4,460	342	115	113
Closing cash balance	12,909	4,460	342	115	113	334

Table 7: *Projected statement of consolidated cash flows for the five years ended 30 June 2023.*

Projected Statement of Consolidated Balance Sheet for the Five Years Ended 30 June 2023						
	30/06/2018 $000	30/06/2019 $000	30/06/2020 $000	30/06/2021 $000	30/06/2022 $000	30/06/2023 $000
Current assets						
Short term investments and cash	12,909	4,460	342	115	113	334
Debtors	7,360	7,507	7,657	7,810	7,967	8,126
Prepayments	942	942	942	942	942	942
Inventory	380	380	380	380	380	380
Total current assets	**21,591**	**13,290**	**9,321**	**9,247**	**9,402**	**9,782**
Less current liabilities						
Creditors	5,321	5,427	5,536	5,536	4,982	5,082
Personnel liabilities	2,882	2,940	2,998	3,058	3,120	3,182
Income in advance	3,057	3,057	3,057	3,057	3,057	3,057
Provision for tax	235	228	238	246	265	275
Total current liabilities	**11,495**	**11,652**	**11,830**	**11,898**	**11,424**	**11,596**
Net working capital	**10,096**	**1,638**	**(2,508)**	**(2,651)**	**(2,022)**	**(1,813)**
Investments						
Investments in subsidiaries and associates/intangible assets	369	369	369	369	369	369
Intangible assets	869	869	869	869	869	869
Total investments	**1,238**	**1,238**	**1,238**	**1,238**	**1,238**	**1,238**
Fixed assets						
Fixed assets	31,249	41,407	47,327	52,405	54,149	52,484
Biological assets	548	548	548	548	548	548
Total fixed assets	**31,797**	**41,955**	**47,875**	**52,953**	**54,697**	**53,032**
Term liabilities						
Provision for staff liabilities	1,237	1,262	1,287	1,313	1,339	1,366
Deferred tax liability	980	980	980	980	980	980
Term debt	0	0	0	3,100	3,500	0
Total term liabilities	**2,217**	**2,242**	**2,267**	**5,393**	**5,819**	**2,346**
Projected total net assets	**40,914**	**42,589**	**44,338**	**46,147**	**48,094**	**50,111**
Represented by						
Share capital	17,516	17,516	17,516	17,516	17,516	17,516
Retained earnings b'fwd	21,140	23,337	25,012	26,761	28,570	30,517
Revaluation reserve	61	61	61	61	61	61
Current profit (loss)	2,197	1,675	1,749	1,810	1,947	2,017
Projected closing shareholders' funds	**40,914**	**42,589**	**44,338**	**46,147**	**48,094**	**50,111**
Shareholders' funds to total assets	**0.75**	**0.75**	**0.76**	**0.73**	**0.74**	**0.78**

Table 8: *Projected statement of consolidated balance sheet for the five years ended 30 June 2023.*

Performance monitoring and reporting

Scion's strategic indicators, measures and targets are presented in Table 9. 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 the appendix. Financial indicators reported quarterly are presented in Table 5.

Investment

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	2018 Forecast	2019 Target
End user collaboration	Revenue per FTE ($) from commercial sources	Quarterly	$76,401	$76,568
Research collaboration	Publications with collaborators	Quarterly	>80	>90
Technology and knowledge transfer excellence	Commercial reports per scientist FTE	Annually	1.0	1.0
Science quality	Mean citation score	Annually	2.3	2.6
Financial indicator	Revenue per FTE ($)	Quarterly	$170,825	$174,496
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	MBIE survey n>30; >85%	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	>90%	>90%
Māori economic development	Partnerships (number and value) established with Māori entities to support economic development through the forest industry	Quarterly	n>5; >$1m	n>5; >$1m
Accelerated commercialisation	Technologies in Scion's pipeline (number and co-investment ($)); projects that progress to the business case stage (case studies)	Quarterly	25 & $600k; Cases >4pa	25 & $600k; Cases >4pa
Internationalisation	Joint research and technology development programmes and staff exchanges with Scion's international strategic partner organisations	Six monthly	10 1	10 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 <50 days EEO rating Safety first	Qualitative <50 days EEO rating Safety first

Table 9: *Scion's performance monitoring scorecard indicators and measures.*

Appendix: Accounting policies

1. 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 financial statements consist of New Zealand Forest Research Institute Limited and its subsidiaries (the Group).

New Zealand Forest Research Institute Limited (the Company) is a reporting entity for the purposes of the Financial Reporting Act 2013. 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 period 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 2013. The financial statements have also been prepared on a historical cost basis, except for forestry assets, derivatives, carbon credits 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. This includes the New Zealand equivalent to International Financial Reporting Standard 34 – Interim Financial Reporting. The financial statements comply with International Financial Reporting Standards (IFRS).

c) Basis of consolidation

The consolidated financial statements comprise the financial statements of the Group and its subsidiaries as at 31 December. Control is achieved when the Group is exposed, or has rights, to variable returns from its involvement with the investee and has the ability to affect those returns through its power over the investee. Specifically, the Group controls an investee if and only if the Group has:

- Power over the investee (i.e. existing rights that give it the current ability to direct the relevant activities of the investee)
- Exposure, or rights, to variable returns from its involvement with the investee, and
- The ability to use its power over the investee to affect its returns.

When the Group has less than a majority of the voting or similar rights of an investee, the Group considers all relevant facts and circumstances in assessing whether it has power over an investee, including:

- The contractual arrangement with the other vote holders of the investee
- Rights arising from other contractual arrangements
- The Group's voting rights and potential voting rights.

The Group re-assesses whether or not it controls an investee if facts and circumstances indicate that there are changes to one or more of the three elements of control. Consolidation of a subsidiary begins when the Group obtains control over the subsidiary and ceases when the Group loses control of the subsidiary. Assets, liabilities, income and expenses of a subsidiary acquired or disposed of during the year are included in the statement of comprehensive income from the date the Group gains control until the date the Group ceases to control the subsidiary.

All intra-group assets and liabilities, equity, income, expenses and cash flows relating to transactions between members of the Group are eliminated in full on consolidation.

A change in the ownership interest of a subsidiary, without a loss of control, is accounted for as an

equity transaction. If the Group loses control over a subsidiary, it:

- Derecognises the assets (including goodwill) and liabilities of the subsidiary
- Derecognises the carrying amount of any non-controlling interests
- Derecognises the cumulative translation differences recorded in equity
- Recognises the fair value of the consideration received
- Recognises the fair value of any investment retained
- Recognises any surplus or deficit in profit or loss
- Reclassifies the parent's share of components previously recognised in OCI to profit or loss or retained earnings, as appropriate, as would be required if the Group had directly disposed of the related assets or liabilities.

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 those acquired 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 de-recognition 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.

Carbon Credits. New Zealand emission reduction units (NZUs) are recognised when the Group controls the units, provided that it is probable that economic benefits will flow to the Group and the fair value of the units can be measured reliably. Control of the NZUs arises when the Group is entitled to claim the NZUs from the government.

NZUs are initially measured at fair value on entitlement as an intangible asset unless the Board has determined they are held for sale, in which case they would be recorded at fair value as inventory.

Following initial recognition, the intangible asset is measured at fair value when the Board of Directors consider there is an active market for the sale of NZUs. NZUs determined as held for sale at recognition and recorded as inventory, are subsequently measured at the lower of cost and net realisable value.

The liability arising from the deforestation of eligible land is measured using the market value approach. A liability exists and is recognised on pre-1990 forests if the land use changes from forestry.

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 on an annual basis.

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	20–60 years
Plant and equipment	3–20 years
Furniture and fittings	10–20 years
Motor vehicles	3–7 years

h) **Recoverable amount of non-current assets**
On an annual basis the group assesses whether there is any indication 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 defined benefit plan provisions are based on annual actuarial valuations completed at financial year end.

m) Leases

The determination of whether an arrangement is or contains a lease is based on the substance of that arrangement at inception date.

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 three 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)

All items in the financial statements are stated net of GST, with the exception of trade receivables and payables, which are inclusive of GST invoiced.

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 Strategic Science Investment Funding, Endeavour Funding, 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 period 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.

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, costs to complete 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 and disclosed. Details of heritage assets can be found in notes 10 and 21 of the Annual Report 2017.

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.

A valuation is done on an annual basis at each financial year end.

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.

Notes to strategy section

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