STRATEGY TO 2030

January 2020 Update

SCION™

FORESTS ■ PRODUCTS ■ INNOVATION

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Chair and Chief Executive overview

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.

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.

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

The role of the world's indigenous peoples in shaping the future well-being of communities, nations and enterprises is increasingly recognised.

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.
- How best to embrace kaupapa Māori.
- Climate change obligations.
- Demand for sustainable growth and sustainable production.
- Export returns affected as traditional business and commodity models become less viable. Focus on high value-add exports is needed to move away from commodity export of logs and where the quality deteriorates throughout the transport phase.
- Low productivity compared with other countries. New Zealand has the opportunity to move up the value chain to create high-value bioproducts and leverage off our abundant and productive forestry resource.
- Revitalising our regions by focusing on manufacturing to deliver 'Industry 4.0' at smaller scale and with distributed manufacturing that suits New Zealand's diffuse bioeconomy.
- Production ecosystems' vulnerability to increases in abiotic and biotic risks.
- Changing global trade dynamics.

It is exciting that New Zealand is well positioned globally with forestry capability and resource, with a clean, green image and rising opportunities in our regions.

Working through the challenges and opportunities we concluded that forestry could enable very significant outcomes for New Zealand. 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
- All erodible land planted in permanent forests
- Zero water-quality issues from land use
- Sustainable communities and economies in all regions
- High OECD household net wealth ranking
- Much improved living standards

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

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

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

Government policies and initiatives align with the path we are blazing. These include the One Billion Trees programme; the Provincial Growth Fund; Māori development initiatives; the Economic Plan for a Productive, Sustainable, and Inclusive Economy, and the Industry Transformation Plans that will sit under it (including one for the wood processing industry). In addition there will be a range of government initiatives about transitioning New Zealand to a low emissions economy and aimed at sustained environmental improvement of freshwater, biodiversity, waste and resource management.

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

Scion incorporates its regional perspective across the whole forestry value chain - from research into 'nurseries of the future', planting and plant establishment regimes to suit local environments, through to wood processing and the future of biobased manufacturing. One such research area is developing distributed manufacturing, which is looking at technologies to more efficiently manufacture at smaller scales closer to the forestry resource in the regions.

The relationship between Scion and regional New Zealand is particularly acute in Rotorua - physically, economically and culturally. As the third largest employer in Rotorua, many people rely on Scion staff directly or indirectly for their livelihood. Scion provides a wide variety of jobs including highly skilled science jobs and a range of corporate, technical, nursery and field support roles.

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, nationally and regionally.

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. In this role, it is critically important that we identify the beneficiaries so that we can target the right revenue sources thereby allowing us to balance contestable funds for great ideas and the appropriate sources for critical programmes to deliver on New Zealand's future needs.

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.

This can best be summed up as Scion helping "Transition New Zealand to a circular bioeconomy".

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. 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 $30 billion to New Zealand's GDP, including $2 billion in fuel and plastics substitutions (imports) and $15 billion in exports due to new bioproducts and 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 2020-2025.

Dr Helen Anderson
Chair

Dr Julian Elder
Chief Executive

Scion's strategy to 2030

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
- All erodible land planted in permanent forests
- Zero water-quality issues from land use
- Sustainable communities and economies in all regions
- High OECD household net wealth ranking
- Much improved living standards

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. Timber is 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.

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
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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 below.

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 the well-being of their inhabitants.

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.

Current unsustainable land use practices are not acceptable, accompanied by increasing concern worldwide about access to clean water. 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].

Sustainable production is important with consumers around the world increasingly demanding sustainable production practices that protect the environment and conserve biodiversity.

We are seeing a **global bioeconomy response:** Both the Organisation for Economic Co-operation and Development 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, with many having specific circular bioeconomy strategies.

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.

Huge global demand for fibre driven by sustainability considerations. Fibre, including wood, is increasingly the base for diverse products such as building products, packaging, clothing, bioenergy, biofuels, biochemicals and bioplastics.

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 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. Trade dynamics are shifting both through new broad alliances that remove barriers and a rise in fortress mentalities from countries that increase barriers.

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

How is New Zealand affected?

Like other nations, New Zealand needs to respond to these global challenges and trends. 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

[1] From article retrieved 13 March 2018 from https://rb.gy/jperhw

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.

Scion will be part of that response. Now is the time to address:

- Demand for sustainable growth and production to provide a better balance of economic, environmental and social outcomes. We can double productivity of our forest growing giving New Zealand even more wood feedstock and great ecosystem services from the forests. Shifting from fossil-fuel based products to bio-alternatives will drive greater sustainability.
- Our climate change obligations, which are a significant liability. Forestry and bioproducts from trees as alternatives to fossil-fuel heavy materials are a key part of the solution.
- Vulnerability of our production ecosystems to increases in abiotic and biotic risks. This is a major economic risk for a biobased economy like New Zealand.
- Our low productivity, compared with other countries increasing their productivity through science and technology innovations. New Zealand has particular opportunity to move up the value chain to create high-value bioproducts. This can leverage off the huge base of feedstock we have in our highly productive and efficient forestry estate.
- Revitalising our regions. Focusing on manufacturing to deliver 'Industry 4.0' with smaller scale and distributed manufacturing that suits New Zealand's diffuse bioeconomy. It will allow manufacturing close to the resource and drive economic development in regions where much of the resource is located.
- Traditional business and commodity models becoming less viable and affecting export returns. For many years New Zealand has talked about moving from 'volume' to 'value'. Developing novel bioproducts will benefit both the domestic market and New Zealand exports. We can stop letting trees, our primary produce, being exported as logs, in a state where the quality deteriorates throughout the transport phase, and we can build resilience into our exports by diversifying products and markets.
- Changing global trade dynamics, e.g. the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, rising protectionism and technical barriers to trade.

Addressing Government priorities

Government policies and initiatives respond to many of these challenges and opportunities. Of most relevance to Scion are:

Forestry and the primary sector. The primary sector remains a key driver of New Zealand's economy, including food, wood and other commodities. The Government's goal for the land-based sectors is that "New Zealand becomes the world leader in the provision of high value, environmentally sustainable primary products and services". Policies to support the primary sector will remain central to successive governments:

- To provide guidance on land use and the primary sector the Government formed two separate Ministerial advisory groups – the Primary Sector Council (although with no Ministerial Advisory Group (FMAG). Both groups provide strategic advice to the Government on opportunities and challenges facing the primary industries and work to develop sector wide vision. The groups report to the Minister for Primary Industries and Minister of Forestry respectively. The Primary Sector Council completed its two-year term and is likely to evolve into Food and Fibres Aotearoa New Zealand. The exact scope and nature of that group, which may include forestry representation, is still to be finalised.
- The One Billion Trees programme, now in its third year, is a flagship government policy. Its goal of planting one billion trees by 2028 is well underway with over 150 million trees planted. While most funding is directed to landowners for planting, the programme supports "innovative ideas, research and sector development that will improve the way we plant and grow trees" with a focus on "Right Tree, Right Place, Right Purpose".
- To further support forestry the Government created Te Uru Rākau as part of the Ministry for Primary Industries (MPI) to drive the operational aspects of its forestry policies, including managing the One Billion Trees programme and Crown Forestry. Policy around forestry and other primary sectors has remained centralised in MPI.
- Managing land-use change remains a government focus. While there is no overarching policy around this, a range of initiatives focus on supporting land use. These include the Sustainable Land Management and Climate Change (SLMACC) research programme helping the agriculture and forestry sectors with challenges arising from climate change and the Sustainable Food and Fibre Futures fund.
- There are emerging tensions within the primary sector around land use particularly groups of farmers opposed to afforestation policies. To date this has not generated a specific policy response from the Government.

Economic development (including regional economic development). A central tenet of the Government's 2019 Economic plan for a productive, sustainable, and inclusive economy is around increasing the value of goods produced in New Zealand and for export.

- The economic plan is to be implemented through a series of industry transformation plans. Work has begun within MBIE and MPI/Te Uru Rākau on a *Wood industry transformation plan* to "induce at-scale investment in primary and secondary wood processing to maximise regional, economic, environmental and health and safety benefits through the development of targeted investment cases" and "focus on new products and markets and developing the full, long-term, market potential of a forestry-based bio-economy".
- Other key components of the economic plan are:
  (i) the R&D Tax Incentive and the Research, Science and Innovation Strategy to increase business R&D, innovation and the use of new ideas and technology, and
  (ii) the Trade for All agenda to support New Zealand businesses to make the most of our international connections and grow the value and reach of our exports.
- To help ensure New Zealand's regions benefit from economic development the Government set-up the Provincial

Kia piki te ora – wood for life

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 the 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, environment 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.

Scion is implementing a co-innovation model with Māori to ensure Te Ao Māori is at the heart of the research and ensuring that mana, mauri, mahi and moni are integrated alongside the use of Mātauranga Māori.

Development Unit within MBIE, including to manage the $3 billion Provincial Growth Fund (PGF) which is now in its last year of its initial three years. Forestry and wood processing projects received over $290 million funding across 80+ projects (including One Billion Tree projects). All New Zealand's main forestry regions have benefited.

Māori development. The Crown-Māori partnership (as set in Te Tiriti o Waitangi) is a focus for the Government. Improving Māori economic and cultural outcomes is an ongoing priority. Māori are significant landowners, and forestry offers a firm foundation for Māori development. Key government initiatives are:

- Ahuwhenua - to enable whānau to actively connect with and use their land for social, cultural and economic wellbeing.
- Enterprising whānau - to enable whānau to grow their capability and access opportunities to develop sustainable enterprises.
- Most other major government initiatives, including One Billion Trees and the PGF, have significant Māori development foci.

Low emissions economy. The Government has identified addressing climate change as one of its and New Zealand's key priorities.

- Through the Zero Carbon Act, the Government set new domestic greenhouse gas emissions reduction targets for New Zealand and established a system of emissions budgets to act as stepping stones towards the long-term target.
- The independent Climate Change Commission, established in December 2019, has a significant role in guiding New

Zealand's economic transition towards a low emissions economy. The commission provides independent expert advice to the Government on setting, and to monitor and review progress towards emissions reduction and adaptation goals.
- These changes are supported by other key policies around lowering vehicle emissions, increasing renewable energy, reducing emissions from industrial heat, the built environment, including higher-density urban design, and afforestation (through the One Billion Trees programme).

Environmental improvement. Significant government initiatives are focusing on environmental improvement. Forestry, waste processing and other circular bioeconomy work can make significant contributions to these initiatives and policies, which include:
- Freshwater reforms through the *Good farming practice for water quality action plan*, the *Our freshwater 2020* report and partnerships based on good farming practice principles.
- Review of the Waste Minimisation Act and options to increase the waste levy, which funds the Waste Minimisation Fund.
- Reform of the Resource Management Act and proposing new national policy statements on biodiversity, freshwater, urban development, highly productive land and air quality.
- The Department of Conservation is undertaking significant work on biodiversity by updating the *New Zealand biodiversity action plan*.
- The Parliamentary Commissioner for the Environment remains very active with recent relevant investigations into reducing fossil fuels in New Zealand, environmental reporting, biodegradable and compostable plastics, plus the *Farms, forests and fossil fuels* report.
- The Prime Minister's Chief Science Advisor released a key investigation *Rethinking plastics in Aotearoa*.

Government priorities in the near future. Future government priorities will be significantly influenced by the 2020 General Election**.** This could significantly alter government priorities. Some initiatives that benefit the forestry sector, such as One Billion Trees programme and the Provincial Growth Fund, are flagship policies of the current coalition government. Whether these policies continue, and what other government policies are emphasised will depend on the outcome of the election.

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 medium-density timber with good stiffness and strength, and has a pale yellow appearance. A non-durable species, radiata pine can be chemically, thermally and mechanically manipulated 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 such as 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 (like land protection) and the potential to create commercial outcomes.

Industries are represented by umbrella organisation 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. In 2012, Woodco acknowledged new forest-based manufacturing 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.

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 in increasing onshore processing of trees within New Zealand is mutual. For the growers this means limiting exposure to international markets, and for the manufacturers it means maximising capital use and having confidence to invest in plant and equipment. The challenge is for domestic manufacturers' ability to pay for logs in the face of an international shortage of softwood fibre and the ability to add value to those logs and produce 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, which is expected to continue. The increasing influence of Māori and Māori business models is expected 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.

Attention to forest diversification is rising as participants in tree growing are changing and different markets are emerging (e.g. energy, substituting tropical hardwoods, capturing 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 the wood processing industry in New Zealand. Although most houses in New Zealand are wood framed, opportunity lies in penetrating the commercial and multi-storey building market and the wood construction innovation required to achieve this.

Non-timber manufacturing

Most definitions of the forest industry focus on forest growing and wood manufacturing. But trees can be made into a wide variety of materials suitable for general manufacturing. "Anything made from fossil-based materials today can be made from a tree tomorrow", says global renewable materials company Stora Enso. This includes bioplastics, biochemicals, biofuels and bioenergy.

Production of bio-derived products is growing rapidly around the world. The New Zealand challenge relies upon de-risking opportunities onshore and adapting those to our domestic context. Packaging is another example where there is a need to rapidly evolve to meet the increasing demands of modern supply chains and consumer expectations.

Increasingly Scion's stakeholders include plastics manufacturers, fuel and energy companies, primary producers interested in sustainable packaging and other solutions and industry bodies that support them, such as Plastics New Zealand.

Some of the materials and innovations Scion works on may form the basis of industries that are nascent or do not exist in New Zealand, such as biochemicals. This presents a funding challenge as industries still to emerge cannot provide research and development funding for the science to underpin those economic development opportunities.

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[2]. 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 remain with fragmented land ownership, remoteness from other commercial activities, accessing working capital, managing inter-generational investment and developing employment.

Despite 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.

New Zealand Government policy and operations

In addition to funding science, the Government is a consumer and end-user of science, both to inform government policy development and for government operations.

Scion's research around forest systems, ecosystems, biodiversity, water quality, carbon sequestration by trees, fossil fuel substitution (such as biofuels and bioplastics) and distributed manufacturing all provide useful evidence to inform the development of government climate change, biodiversity, environmental, and economic policies. Scion is increasingly submitting on a range of government policy consultations through the Ministry for the Environment, the Climate Change Commission, Department of Conservation and MPI.

Key government operational responsibilities such as biosecurity (through Biosecurity NZ as part of MPI) and rural fire prevention and fighting for Fire and Emergency New Zealand are also advanced and informed by Scion's research in these areas. This work provides significant public benefit for New Zealand as whole.

Very little government funding is allocated for those governmental departments and agencies to pay for that input and research. The science system funding system is not well set up to invest in such policy and operational input to government.

Science

The Government has consulted on and is still finalising its *Research, science and innovation* strategy. The draft strategy aims for New Zealand to be "a global innovation hub, a world class generator of new ideas for a productive, sustainable and inclusive future". It reinforces the 2015 strategy's focus on 'science excellence' and 'impact' and proposes adding 'connections' as a third pillar. Importantly the draft strategy focuses the role of government-funded science on public good and the 'frontier'. The strategy suggests that user focus research should be funded by end-users, with government support for end-user science focused through the R&D tax credit.

The range of science investments is evolving. The national science challenges (formed in 2013) are substantial and focus on tackling big national problems with stretchy science. Scion participates in six challenges. Also substantial is the refreshed science investment approach – the Endeavour Fund introduced in 2015. The fund has two highly contested 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".

In 2017, MBIE reshaped CRI core funding into the 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 ensuring support for capability of national importance. Scion manages three platforms: Forest systems, Manufactured products from trees, and an infrastructure platform - National Forestry Herbarium. These platforms are seven-year investments and provide some stability.

It is against this science backdrop that Scion seeks to deliver on its core purpose.

[2] (Nana, G., Stokes, F., & Molano, W (n.d.) The asset base, income, expenditure and GDP of the 2010 Maori economy. Wellington, New Zealand: Maori Economic taskforce. https://rb.gy/9dh4jn

Scion's regional perspective

Forestry, by virtue of its physical locations, is a critical industry for regional New Zealand. Helping the regions succeed is a key part of Scion creating impact for New Zealand.

How Scion's science can be used at local and regional scales is an important consideration.

The concept of "right tree, right place, right purpose" is centred around doing what is best in local circumstances. Our work on forest and landscapes includes researching the ecosystem services forests provide to improve the environment and benefit local communities. How trees and forests integrate into farms and in urban environments is another important aspect of our research programmes.

Scion incorporates a regional perspective across the whole forestry value chain – from research into 'nurseries of the future', planting and plant establishment regimes to suit local environments, through to wood processing and the future of biobased manufacturing. One such research area is developing distributed manufacturing, which is looking at technologies to more efficiently manufacture at smaller scales closer to the forestry resource in the regions.

The relationship between Scion and regional New Zealand is particularly acute in Rotorua – physically, economically and culturally:

- As the third largest employer in Rotorua, many people rely on Scion staff directly or indirectly for their livelihood. We provide a wide variety of jobs including highly skilled science jobs and a range of corporate, technical, nursery and field support roles.
- Our campus at Te Papa Tipu Innovation Park is home to around 30 business partner companies. Our innovation and R&D research adds value for local forestry and manufacturing companies, increasing the value and jobs they bring to the local community.
- We liaise closely with Rotorua Lakes Council and the Rotorua Economic Development agency to support the development and future of Rotorua.
- We work closely with the local community. Being located alongside The Redwoods – Whakarewarewa Forest, Scion has worked with the Rotorua Trails Trust to develop some mountain bike tracks in the forest. We have helped with the revitalisation of the Ohinemutu shared gardens and held a volunteer day with our neighbour Whakarewarewa – The Living Māori Village. In Christchurch, our staff worked with Orana Wildlife Park as part of an annual working bee.
- Scion has strong links and strengthening partnerships with local iwi including Te Papa Tipu's tangata whenua Ngāti te Kahu, Ngāti Taeotu, Ngāti Hurungaterangi and our wider iwi of Ngāti Whakaue and Te Arawa including our neighbours from Whakawerawera and Te Puia. Tangata whenua representatives are based in Scion's offices to foster co-innovation on research and other projects (such as Scion's new innovation hub and the cultural connections it will foster).

The pivotal role of Scion

Scion will respond to all these drivers as we undertake research and development 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.

This can best be summed up as Scion helping "Transition New Zealand to a circular bioeconomy".

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 centred around the objective to plant and grow the 'right tree in the right place for the right purpose'.

Scion Strategy 2030 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.

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

Imperatives	2030 Impact Areas	Impacts
Grow New Zealand's exports Meet climate change commitments Reduce environmental stress and land erosion and enhance water quality Accelerate Māori economic development Increase disposable household incomes Build more affordable homes in our cities and regions Meet consumer demand for products that are sustainable and do not harm the environment Respond to global trade changes and competition	**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	• Strong Treaty-based science partnerships • Increased value from land managed for wood and fibre production and ecosystem services, including carbon sequestration • Increased resilience of forests to biotic and abiotic risks • Diversified forests supporting local and distributed manufacturing and regional growth, leading to healthy and flourishing communities • Increased use of timber and fibre in the built environment • Growth in manufacture of biobased products including energy • Maintained licence to operate across the value chain and export markets

Figure 1: *From imperatives to national impacts.*

We have further elaborated and grouped the research we will do under our three impact areas into eight **research themes**: two themes per impact area and two cross-cutting themes that are critical to the success of all three impact areas.

Impact Area (IA)	Research theme	Goal	Description
IA1: Forests and landscapes To grow healthy, resilient forests that are planted primarily for their standing-forest benefits	Indigenous forestry	Enhancing indigenous forests by leveraging plantation forestry technologies and knowledge	Learning to grow indigenous trees at pace and scale economically, increase success rate and improve understanding of and management of planted indigenous forests to improve indigenous forest outcomes and opportunities
	Forest ecosystem services	Capturing and optimising the environmental and social benefits of forests	Understanding, defining and valuing the processes and services forest ecosystems provide to improve environmental outcomes (e.g. water and air quality, carbon sequestration, biodiversity, erosion control) and human well-being (e.g. recreational use)
IA2: 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	Improving plantation forestry	Transforming productivity, diversity and resilience of plantation forests for future timber needs	Ensuring plantation forestry evolves to deliver higher value timber and new value timber from more productive and diverse forests, with emphasis on the needs of future communities and forest function
	Sustainable circular urban communities	Developing biobased options to build sustainable circular cities and communities	Developing environmentally sustainable urban systems, including improved timber products for structural and architectural applications; rethinking wastewater and other infrastructure design and developing urban (small-scale) forests
IA3: Biobased manufacturing and products To grow healthy, resilient forests that replace petrochemicals and non-sustainable materials with products from trees and other biomaterials	Transformational bioindustries	Crafting distributed manufacturing and biorefineries to create thriving regions	Developing and scaling up technologies to transform biomass (including fibre, purpose grown trees and waste) into bioenergy, high-value chemicals and other biocomponents at industrial scale, with a focus on distributed and regional manufacturing, industrial symbiosis and redesigning supply chains
	Biomaterials	Designing biomaterials to create products for sustainability-conscious consumers	Creating New Zealand biofibre, biochemicals, and other biomaterials to be used to create sustainable bioproducts and packaging (including for use in modern design and fabrication solutions (e.g. 3D/4D printing, mass customisation, blockchain provenance tracking)
Cross-cutting	Risk and biosecurity	Managing risk to protect and enhance New Zealand's bioeconomy resources	Improving biosecurity and climate risk mitigation management and technologies to maintain and enhance forest productivity and product realisation. Developing tools and advice to overcome societal and regulatory barriers hindering the transition to a circular bioeconomy
	Māori forestry futures	Ensuring forestry and bioeconomy research integrates Māori perspectives and benefits Māori	Building science and research partnerships with Māori with a focus on enhancing Māori use of land and forestry resources to realise the economic, social, environmental and cultural opportunities of the circular bioeconomy

Figure 2: *Scion's research themes.*

These impact areas and research themes are targeted to deliver against government objectives in the following way:

Research themes	Description	Low-emissions economy	Environmental improvement	Healthier communities	Māori communities	Protect and enhance NZ industry and exports	Create new economic opportunities	Regional economic development/just transition	Māori economy	Digital age	Benefit to New Zealand (Impact)
Indigenous forestry	Learning to grow indigenous trees at pace and scale economically, increase success rate and improve understanding of and management of planted indigenous forests to improve indigenous forest outcomes and opportunities	●	●				●	●	●	●	• Increase in planted indigenous forests. • Improved health of planted and natural indigenous forests • Greater integration of the economy with te ao Māori • Potential new high-value bioindustries using the unique properties of indigenous trees
Forest ecosystem services	Understanding, defining and valuing the processes and services forest ecosystems provide to improve environmental outcomes (e.g. water and air quality, carbon sequestration, biodiversity, erosion control) and human well-being (e.g. recreational use)	●	●	●	●						• Improved environmental outcomes in and around forests and other lands uses (e.g. farms, cities) integrated with forestry • Improved human well-being from recreational use • Improved social licence for an important economic sector (i.e. decrease tension between economic sectors)
Improving plantation forestry	Ensuring plantation forestry evolves to deliver higher value timber and new value timber from more productive and diverse forests, with emphasis on the needs of future communities and forest function	●	●			●	●	●	●	●	• Increase in economic returns of forestry • Higher quality, higher tech engineered and higher value timber • Greater productivity per ha of planted forests • Increased automation • More diverse and resilient forest • Greater use of timber (including locking up carbon for longer)
Sustainable circular urban communities	Developing environmentally sustainable urban systems, including improved timber products for structural and architectural applications; rethinking wastewater and other infrastructure design and developing urban (small-scale) forests	●	●	●	●		●			●	• More livable and sustainable cities and communities • Locking carbon up for longer (in timber in buildings) • Low emissions, sustainable, locally sourced building materials • Better automation and digital connectedness • More resilient cities (from distributed infrastructure and better buildings) • Healthier homes and buildings
Transformational bioindustries	Developing and scaling up technologies to transform biomass (including fibre, purpose grown trees and waste) into bioenergy, high-value chemicals and other biocomponents at industrial scale, with a focus on distributed and regional manufacturing, industrial symbiosis and redesigning supply chains	●	●				●	●			• New industries (including in the regions and close to feedstock) • Substitution of fossil fuels for lower/no emissions alternatives • Less waste • Value-add economics by transforming lower value 'waste' into higher-value products • Greater economic efficiency and integration

Figure 3: *Scion's work contributes to government priorities (continued over).*

Research themes	Description	Government priorities									Benefit to New Zealand (Impact)
		Low-emissions economy	Environmental improvement	Healthier communities	Māori communities	Protect and enhance NZ industry and exports	Create new economic opportunities	Regional economic development/just transition	Māori economy	Digital age	
Biomaterials	Creating New Zealand biofibre, biochemicals, and other biomaterials to be used to create sustainable bioproducts and packaging (including for use in modern design and fabrication solutions (e.g. 3D/4D printing, mass customisation, blockchain provenance tracking)	●	●			●	●	●	●	●	• New industries (including in the regions and close to feedstock) • Substitution of fossil fuels for lower/no emissions alternatives • Potential new high-value bioindustries using the unique properties of indigenous trees • Value-add economics by transforming lower value 'waste' into higher-value products • Creating less waste through design thinking and new manufacturing models • Lower non-tariff barriers for New Zealand exports
Risk and biosecurity	Improving biosecurity and climate risk mitigation management and technologies to maintain and enhance forest productivity and product realisation. Developing tools and advice to overcome societal and regulatory barriers hindering the transition to a circular bioeconomy	●	●			●	●	●	●	●	• Protecting our forests and $7 b of exports from pests, disease, fire and climate change • Protecting natural heritage from kauri dieback, myrtle rust and other risks
Māori forestry futures	Building science and research partnerships with Māori with a focus on enhancing Māori use of land and forestry resources to realise the economic, social, environmental and cultural opportunities of the circular bioeconomy			●	●		●	●	●		• Strong treaty-based science partnerships • More effective utilisation of Māori land • Increased high-value bioeconomy opportunities for Māori

Figure 3 continued: *Scion's work contributes to government priorities.*

Core and critical capability

To deliver on these impact areas and research themes undertakes work in a variety of ways through our own capability, joint programmes with others, collaboration with international partners and the like. The following table outlines the capability that Scion sees as core to its ability to deliver. The table also highlights who the beneficiaries are of these core capabilities.

Key capability	Areas of primary focus	Value proposition	Government operations/ regulation	Public good	Industry/sector good
Plant science - forest species	Breeding forest plant species (genetics, biotechnology)	Genetic improvement for desired traits and better resilience (biotech required for most significant improvements)	Biosecurity/ resistance to pests and disease	Climate mitigation and resilience	Improved and fit-for-purpose trees
	Propagating forest plant species (germplasm, tissue culture, nursery)	Seedlings/clones can be grown at pace and cost effectively with increased survival rates			Tree and forest health; Cost efficiencies and effectiveness
	Whole plant physiology (endogenous symbionts, nutrition, development, reproduction, phenotyping, non-destructive tools)	Understanding whole plant performance delivering designed and healthy trees into value chains			Improved tree survival and quality; fit-for-purpose trees
Understanding forest ecosystems	Biotic forest dynamics (soil, microbiomes, understorey crops)	Understanding the holistic interactions between soil, trees and other species to improve tree growth and forest productivity, including in a changing climate			Improved forest health and productivity
	Abiotic forest dynamics (carbon cycling and sequestration, water flows, nutrient cycling)	Understanding the role of forests in carbon sequestration and water management (quality and quantity), particularly to mitigate and adapt to climate change	Carbon sequestration understanding and management	Climate mitigation; Water quality	Improved forest health and productivity
	Remote sensing (phenotyping, forest health, pest/disease understanding, geospatial science)	Management of forests at scale through the integration of digital and sensing technologies (critical given the size, spread and diversity of forests)	Forestry resource understanding; carbon and ETS management; biosecurity		Forest understanding and management; cost efficiencies and effectiveness
	Silviculture (includes forest management, digital forestry and harvesting, robotics and automation)	Improved management to increase forest productivity, improve tree health and wood quality, and enhance worker safety	Health and safety		Improved forest productivity and management; health and safety
	Forest resilience (disease, pest, fire and other climate risks)	Protects forest resources and enhances productivity	Biosecurity; fire management (FENZ); conservation	Protect climate mitigation (carbon sequestration) and other ecosystem services; protect native tree species; protect amenity value	Forest resource protection
	Social and cultural benefits of forests	Understanding the non-monetary value of forests so they can be factored into decision making	RMA and environment regulatory decisions	Non-economic services	
	Integrating forestry (includes value chain economics and land use integration and decision making)	Efficient optimised management through linking together all parts of the value chain from 'seedling' to 'forester/farmer' to 'forest' to 'factory' to 'user/consumer'		Optimised land use (for economic and non-economic benefits)	Efficient and effective value chains

Figure 4: *Core and critical capability (continued over).*

Key capability	Areas of primary focus	Value proposition	Government operations/ regulation	Public good	Industry/sector good
Materials and manufacturing from trees and biomass (timber, biomaterials)	Wood science, wood modification and timber engineering	Timber to meet the demands of modern architectural and engineering uses	Building code support	Climate mitigation (concrete/steel substitution)	Improved products; new products
	Novel and functional biomaterials (includes bioplastics, biochemicals, microbes and bioenergy)	Materials refined or made from wood and biomass constituents can replace fossil fuel-based materials in existing and new products	Zero-Carbon Act/ mitigation targets; economic development	Climate mitigation (fossil fuel substitution)	Improved sustainability and value; new products; new industries
	Packaging	Sustainable, durable, fit-for-purpose and 'smart' packaging solutions for New Zealand products	Government regulations and standards		Improved sustainability and value (including loss prevention); trade access
	Manufacturing processes for biomaterials (extrusion, additive manufacturing, pyrolysis, biorefineries, fermentation, engineering)	New biomaterials can only be useful if they can be processed in existing or novel manufacturing techniques, including distributed and symbiotic systems	Economic development	New knowledge	Enabler for environmentally sustainable products
	Waste processing and recycling (biodegradation, wastewater)	Processing, engineering and recovering waste to create value and reduce environmental impact	Waste management	Less waste and environmental pollution	Value-recovery
Enabling capabilities	Māori co-innovation	Cultural and social connections to forests, critical for breeding and propagation of indigenous trees; management of Māori land; development of value-add industry using Māori owned forestry resource	Treaty of Waitangi obligations	Treaty of Waitangi obligations	Māori business development
	Data science	Data science allows us to fully realise the richness of mega-scale datasets by utilising machine learning to unlock the hidden patterns	Supports resource understanding	Supports resource understanding	Supports resource understanding
	Techno-economics	Pathways to add value and identify and address commercial challenges			Efficient and effective value chains
	Molecular and biological chemistry	Analysis of all materials and alignment to metabolic pathways and plant and microbial materials		Supports resource understanding, new knowledge	Supports resource understanding, new knowledge

Figure 4 continued: *Core and critical capability.*

Revenue sources

To deliver on this strategy it is important to understand who the beneficiaries are and their ability to provide the levels of revenue needed to deliver the capability and the research required.

Scion's revenue is secured from 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. The level of revenue we see as fundamental to our delivery of this strategy is shown in the financials section.

Scion intends to continue efforts to secure funding for our research from the primary beneficiaries of that research. This is in line with the Government's draft *Research, science and innovation strategy*. In practice this means that Scion will:

- Prioritise its SSIF funds towards strategic New Zealand benefit research. This includes research which is: (i) of general public good (where a clear end user cannot easily be identified); (ii) is of benefit to an industry that does not yet exist in New Zealand; (iii) too risky or long-term to be funded by existing industry. It may also be leveraged to attract industry funding.
- Avoid relying on contestable science funding, such as Endeavour Fund, to be the primary funding source for critical capability funding. Contestable funding may be used to extend high-priority research beyond what is possible with SSIF funding; it may be used for novel research that clearly fits with our strategy while recognising that the research may not continue to be funded beyond the term of the contestable funding contract.
- Undertake research where clear end users can be identified if those beneficiaries fund the research. Scion will look to apply this to both private sector beneficiaries as well as research that supports specific government operations (e.g. biosecurity, fire research, carbon analysis for the Government's climate change reporting).
- Not undertake research that is not a strong fit for Scion's strategy, even if someone is willing to fund it.

We recognise that we will need to actively shift our revenue sources to get alignment with this strategy. In addition to the long-term funding solution being worked on with MBIE (which is included in the financials) we are progressing the discussions with existing industry on developing a more viable approach to funding their needs as beneficiaries. The financial plan also includes building up additional revenue source over 5 years in the order of $10 to 12 million for the science related to biotic and abiotic risks. These programmes such as biosecurity and fire activities are ones that do not naturally fit with an Endeavour type funding mechanism. Currently the long-term fire programme is at risk when its Endeavour funding ends in 2021. We will be exploring working with government departments, regional councils and organisations like the Insurance Council to explore long-term solutions to maintaining these capabilities and programmes.

Impact area descriptions and objectives

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.

Impact area milestones allow us to track progress towards the overarching impacts that Scion is targeting its science to enable. Each impact area includes a timeline of milestones that include things we will adapt from elsewhere and things we will invent.

Impact Area 1: 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.

> *"A very different approach to dealing with biological emissions is to use trees to soak up and store carbon dioxide ... For instance a hill country sheep farmer might fence off higher altitude land and leave the mānuka scrub to begin the slow steady recovery into mature podocarp forest, with all the accompanying benefits of slowing erosion, keeping sediment out of waterways, ameliorating flooding, and providing habitat for native birds and other creatures."*
>
> Parliamentary Commissioner for the Environment, October 2016.

By 2030, social, cultural, environmental and economic benefits of exotic and indigenous forests are fully valued, for example, carbon sequestration, biodiversity, erosion and flood control, enhanced water quality, recreation and tourism. New forest systems, designed and managed primarily for ecosystem services will have delivered $2 billion in value over 2018 figures through:

- 100% increase in afforestation of highly erodible red zone land;
- 8 million tonnes increase in sequestered above and below ground carbon storage in new forests;
- 80% increase in forested area managed to enhance soil and water resources, biodiversity, landscape resilience;
- 100% increase in the use of forests for human health and well-being;
- 100% increase in the value of Māori standing forests with maximum carbon net returns defined by land owner values;
- Converting 30% of underutilised Māori land to standing forest plantations.

Research theme 1.1: Indigenous forestry

Goal: Enhancing indigenous forests by leveraging plantation forestry technologies and knowledge.

This theme encompasses research to learn to grow indigenous trees at pace and scale economically, to increase success rate and to improve understanding of and management of planted indigenous forests to improve indigenous forest outcomes and opportunities.

Scion's research in plantation forestry over the last 75 years has established significant national capability, resulting in technological resources and understanding. If applied to indigenous forestry, this national capability could substantially alter the value and understanding of New Zealand's indigenous forests. Recent economic, carbon-based and societal interest in preserving our nation's unique flora and fauna means that harnessing New Zealand's collective forest knowledge (plantation and indigenous), is more important than ever.

Scion's key technical capability in indigenous tree propagation, remote phenotyping, modelling, indigenous silviculture and disease research will be applied in collaboration with Māori partners and Manaaki Whenua – Landcare Research. Key outcomes of this work will focus on co-innovation and partnership, where appropriate a Wai262 framework will be applied, with the key aims of improving indigenous forest durability, knowledge and the ability to steward indigenous forests at scale.

Research theme 1.2: Forest ecosystem services

Goal: Capturing and optimising the environmental and social benefits of forests.

This theme encompasses research to understand, define and

value the processes and services forest ecosystems provide to improve environmental outcomes (e.g. water and air quality, carbon sequestration, biodiversity, erosion control) and human well-being (e.g. recreational use).

New Zealand's indigenous forests, or purposefully designed new forest systems, have the potential to afford New Zealand a globally unique resource. Critically, this represents an opportunity to provide the nation with the potential for distinct intergenerational solutions to environmental challenges, intangible cultural heritage and recreational opportunity. Scion's research will advance our understanding of planted, non-harvested forest habitats helping to define and value the processes and services that forest ecosystems provide.

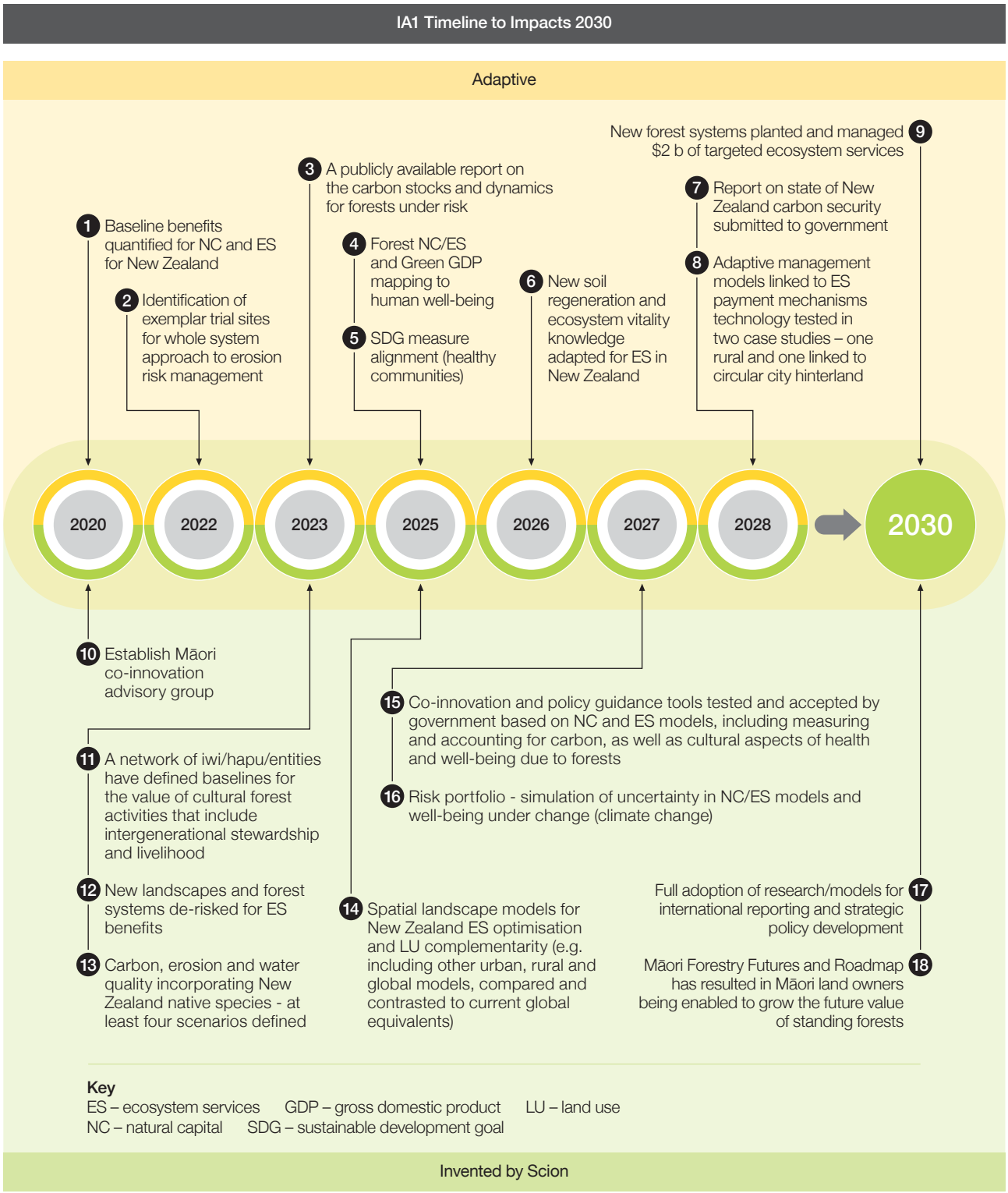


Figure 5: *Impact Area 1: Forests and landscapes milestones.*

Impact Area 2: 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.

Trees have been grown for timber for millennia.

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.

By 2030, current and new forests will produce products for urban applications adding an extra $10 billion to New Zealand's GDP through:

- $7 billion in new houses and engineered timber applications;
- 50% increase in new species (non radiata pine) commercial plantings, harvest and high-value applications;
- 50% increased exports of processed timber and substitution for imported timber and products;
- 10 million tonne carbon locked up in urban environments through adoption of the principles of circularity;
- An increase in MAI (productivity) from radiata pine of an average of 35 m² per year with improved wood quality, uniformity and resilience to pests and pathogens;
- 30% of non-productive Māori land has been cultivated for structural timbers (including indigenous) leading to a 60% increase in high-value jobs for Māori and 300% increase in Māori investment in timber manufacturing and biobased co-innovation.

Research theme 2.1: Improving plantation forestry

Goal: Transforming productivity, diversity and resilience of (exotic) plantation forests for future timber needs.

This theme encompasses research to help ensure plantation forestry evolves to deliver higher value timber and new value timber from more productive and diverse forests, with emphasis on the needs of future communities and forest function.

This theme aims to develop a resilient carbon-based economy based on planted forests under an uncertain future. The research will greatly enhance the long-term productivity and resilience of production forests to support New Zealand's transition to a low-carbon bioeconomy, meet our agreed carbon reduction goals and maximise the benefits from the One Billion Trees programme plus greatly build on the contribution made by the planted forest estate to New Zealand.

Research theme 2.2: Sustainable circular urban communities

Goal: Developing biobased options to build sustainable circular cities and communities.

This theme encompasses research to develop environmentally sustainable urban systems, including improved timber products for structural and architectural applications; rethinking wastewater and other infrastructure design and developing urban (small-scale) forests.

In a resource-constrained world with ongoing population growth and widespread urban intensification, our current linear system (take, use, waste) can no longer be supported. Circular cities require design and construction with sustainable materials and rethinking centralised infrastructure design. Scion is uniquely positioned to lead this area and be part of a global trend.

The research programme focuses on delivering urban design solutions (including urban forests, prefabricated construction and timber engineering), and is tightly linked to Scion's "Improving plantation forestry" research theme. It drives the development of timber-based materials from forests to displace the current use of non-renewable products, extend carbon storage and foster regional wood processing opportunities.

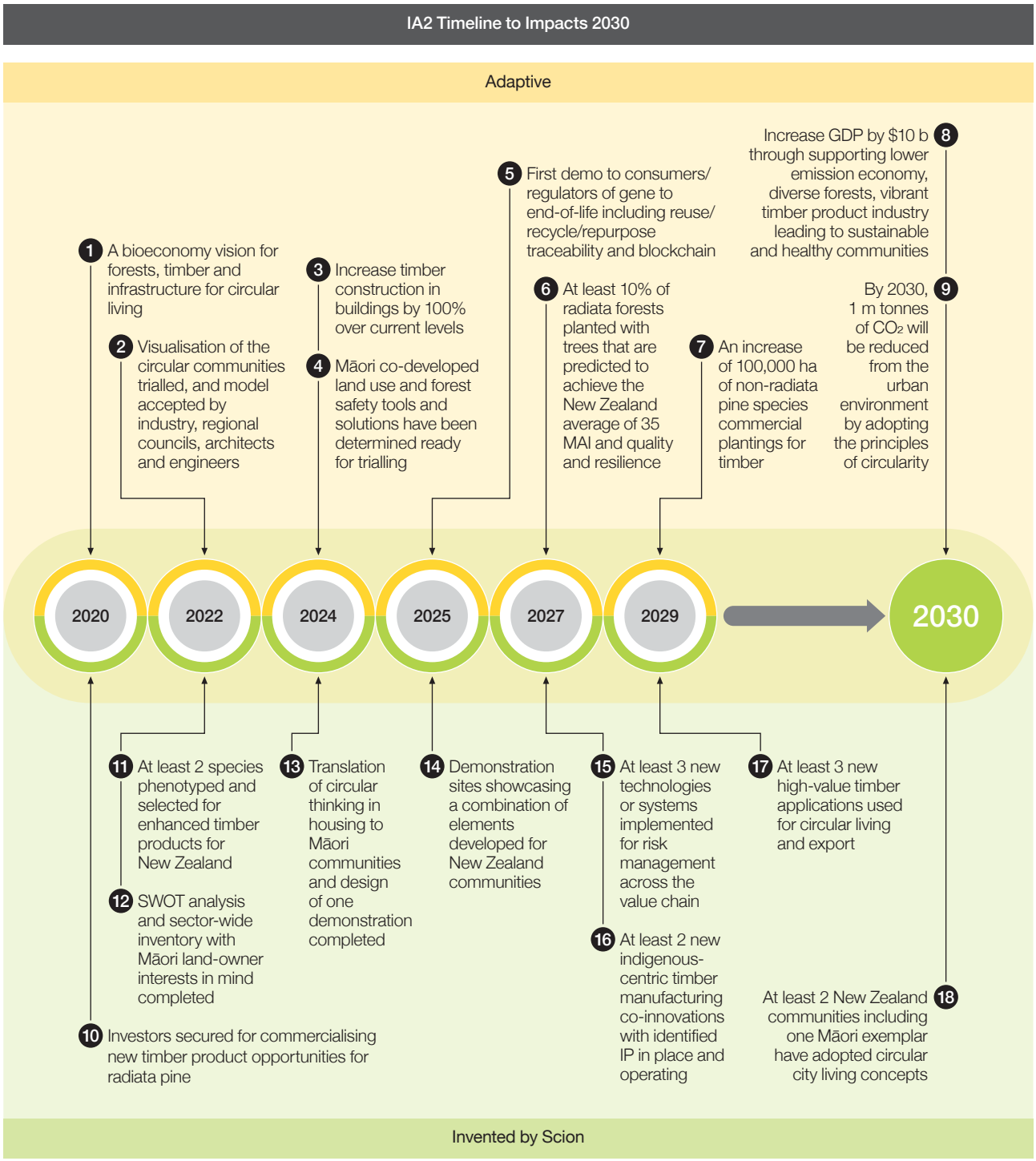


Figure 6: *Impact Area 2: High-value timber manufacturing and product milestones.*

Impact Area 3: 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, bio-chemicals, wood pellets, pulp and paper, fibres and bio-composites. '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.

By 2030, an extra $20 billion will be added to New Zealand's GDP from an emerging biorefinery sector, new fibre-based materials, fuel substitution, new cropping forests and manufacturing processes and regional employment resulting in:

- $2 billion increase in fuel and plastics substitutions (imports);
- $6 billion in exports of fibre and bioplastics;
- 10 million tonne contribution in reduction of CO_2-e;
- Māori bioeconomy performing at the rate of national GDP with $500 million in new investment into new manufacturing value chains.

Research theme 3.1: Transformational bioindustries

Goal: Crafting distributed manufacturing and biorefineries to create thriving regions.

This theme encompasses research to develop and scale up technologies to transform biomass (including fibre, purpose grown trees and waste) into bioenergy, high-value chemicals and other biocomponents at industrial scale, with a focus on distributed and regional manufacturing, industrial symbiosis and redesigning supply chains.

Global disruption to the established paradigm of centralised industry is occurring with increasing frequency in forward-looking economies. These agile, just-in-time approaches are creating regional resilience and growth in new plastics, chemical and energy industries, using decentralised manufacturing occurring near biomass.

New Zealand's combined ability to produce biomass, and lack of embedded infrastructure in these areas, makes it ideally placed to harness similar potential from new industrial symbiosis models. Our biotechnology, genetic and engineering research has been at the forefront of developing applications for New Zealand's unique situational advantage and leverages from historical focus on creating a biomaterials sector.

This theme has a focus on distributed manufacturing and redesigning supply chains. It is expected to deliver new ways to capture and use carbon, with trees as a crop targeted to the end purpose.

Looking into the future this theme represents a nationally significant opportunity to work with iwi to develop high-value indigenous chemical factories, create high-value jobs, innovation and a tech-centric regional New Zealand.

Research theme 3.2: Biomaterials

Goal: Designing biomaterials to create products for sustainability-conscious consumers.

This theme encompasses research to create New Zealand biofibre, biochemicals, and other biomaterials to be used to create sustainable bioproducts and packaging (including for use in modern design and fabrication solutions (e.g. 3D/4D printing, mass customisation, blockchain provenance tracking).

The focus is on ensuring that New Zealand is prepared for greater consumer and supply chain emphasis on sustainability and product knowledge. Increasingly, access to markets and supply chains require proven sustainable products and packaging. As an export economy with a strong global brand, New Zealand has the potential to be world-leading in its approach to packaging and use of biologically-derived carbon to create higher value products.

The research programme uses a mass customisation approach that applies 'designed for circularity' thinking and leverages Scion's established global partner network, while enhancing our existing research in packaging technologies.

In addition, we see significant future opportunity in the revitalisation of Māori bioeconomic traditions using native bio-fibres (e.g. harakeke and kelp) and innovating across other high-value New Zealand-specific natural resources.

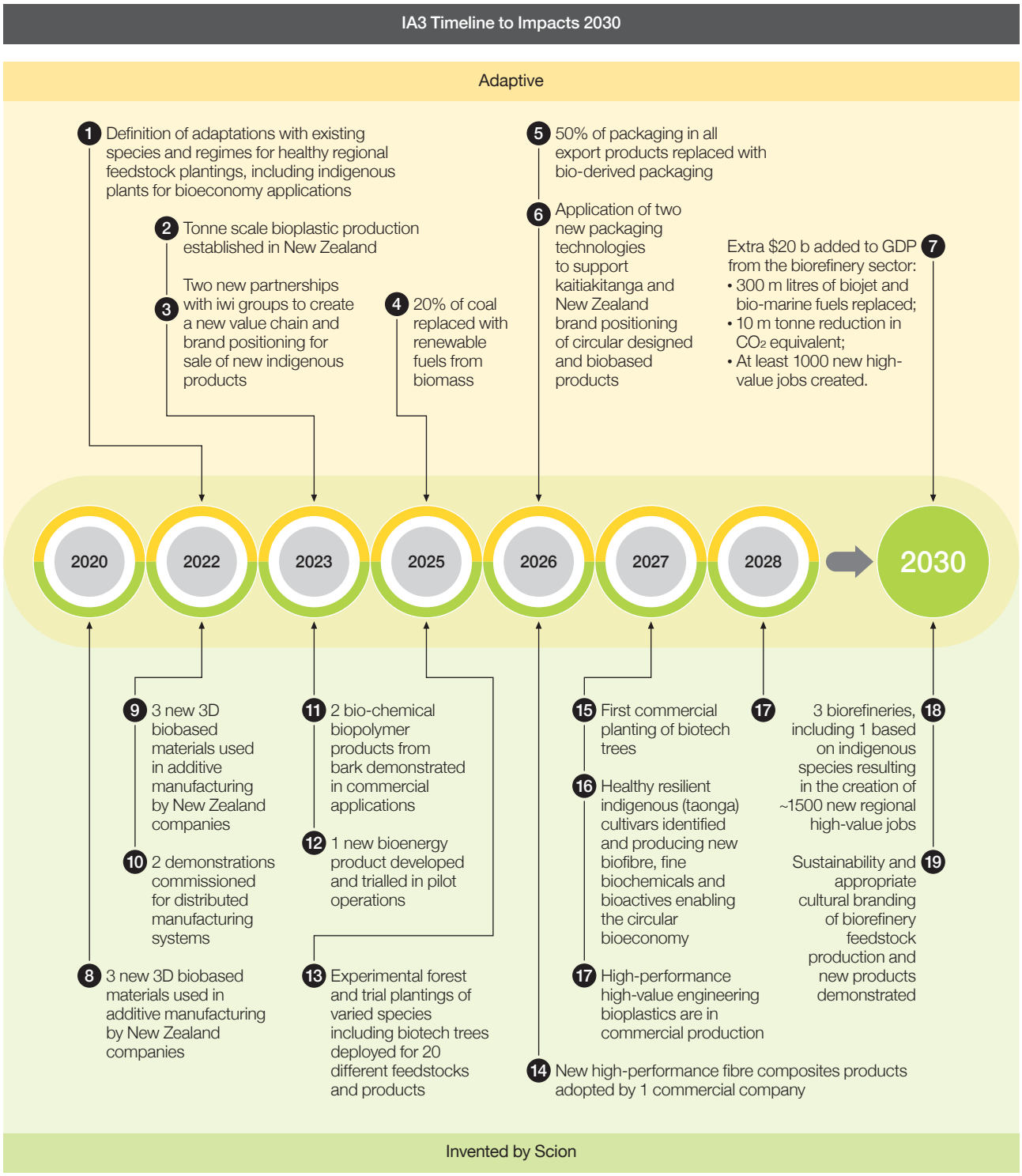


Figure 7: *Impact Area 3: Biobased manufacturing and products milestones.*

Cross-cutting research themes

Research theme 4.1: Risk and biosecurity

Goal: Managing risk to protect and enhance New Zealand's bioeconomy resources.

This theme encompasses research to improve biosecurity and climate risk mitigation management and technologies to maintain and enhance forest productivity and product realisation. This theme will also develop tools and advice to overcome societal and regulatory barriers hindering the transition to a circular bioeconomy.

The path to a circular bioeconomy is lined with considerable challenges. It is expected that new forest systems (i.e. indigenous, urban, bioenergy, improved genetics and the use of targeted varieties) needed to create a circular bioeconomy will intensify risk. Broadly, these risks can be split into human and biological systems-based risks.

Biological and physical risk from pests, weeds, fire, wind and climate change are critical exposures that can slow down realising the potential benefit of a circular bioeconomy. The frequency of extreme events caused by fire, wind, drought and flooding is increasing. This research theme will develop acceptable ways of managing and mitigating the above risks, delivering advanced decision tools, integrated data platforms, technologies and globally leading response strategies.

Human systems risk, based on economic pressure, social perceptions, regulatory risk and non-tariff barriers provide similar negative exposure to the circular bioeconomy. However, unlike biological and physical risk, human system factors have the potential to accelerate or enable circular bioeconomy outcomes, or the requirement for them to exist. Research into human systems risk is expected to deliver validated economic models, identify and address regulatory and social barriers to establishing a circular bioeconomy.

Research theme 4.2: Māori forestry futures

Goal: Ensuring forestry and bioeconomy research integrates Māori perspectives and benefits Māori.

Scion is implementing a co-innovation model with Māori to ensure te ao Māori is at the heart of the research and ensuring that mana, mauri, mahi and moni are integrated alongside the use and protection of Mātauranga Māori.

Māori have an inherently indigenous, intergenerational and circular worldview. Within 30 years, Māori will assume responsibility for 500,000 hectares of national forest assets, be capable of planting forests on their lands, and are already owners of 500,000 hectares of forestry appropriate underutilised land – a forest estate in excess of 1 million hectares as well as control of 600,000 hectares of indigenous forest land. The Māori economy is currently growing faster than national GDP. There are significant opportunities for Māori to be at the forefront of the development of high-tech and high-value manufacturing in the bioeconomy.

This theme will build science and research partnerships with Māori with a focus on enhancing Māori use of land and forestry resources to realise the economic, social, environmental and cultural opportunities of the circular bioeconomy.

All Scion research will be encompassed to ensure Māori are intrinsically linked and appropriately considered. It defines the opportunity for Scion to work with Māori and the pathway to getting there. At the heart of this theme is the opportunity to partner with Māori to undertake world-leading research by utilising Scion science capability and te ao Māori as well as the Māori asset base.

Scion will follow due process in developing research to ensure appropriate processes and protocols are applied to provide for Māori values and relationships. This process will ensure that Scion optimises the opportunities to partner with Māori alongside protecting relationships and data sovereignty.

Two key outcomes: Scion programmes will be strengthened as a result of the increased process and partnership with Māori; and more Māori-led research programmes will be developed.

Shaping Scion

Our expertise and reach

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.

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 in sectors like packaging and waste, 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 8: *Scion infrastructure, capabilities, partnerships and collaborations combine to deliver economic, environmental and social benefits for New Zealand.*

Gene-to-product. In order to plant and grow the right tree in the right place for the right purpose we need integrated research and innovation programmes. 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.

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.

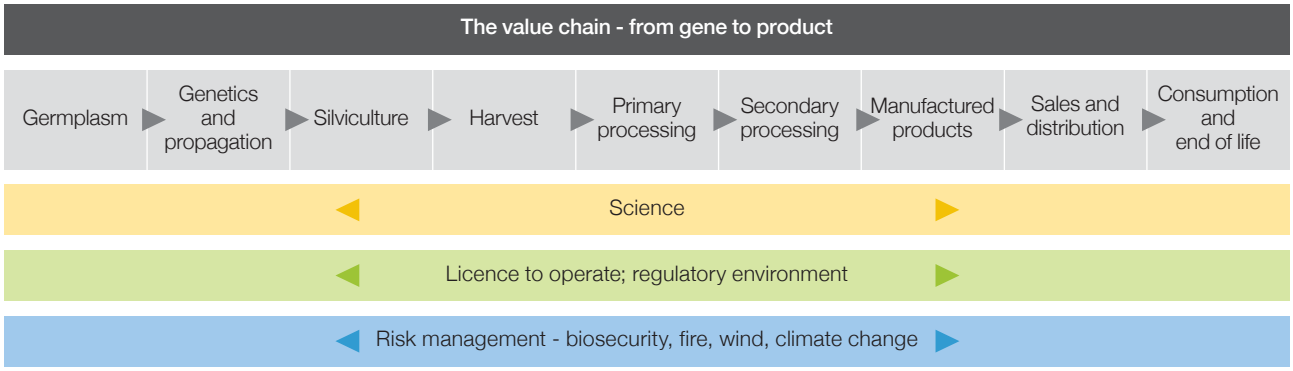
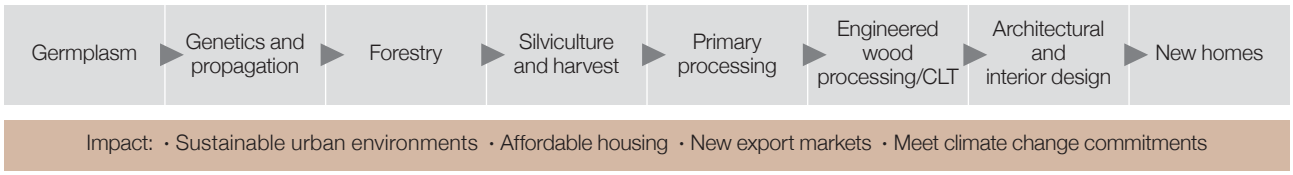


Figure 9: *The value chain – from 'gene to product'.*

Forests and landscapes

High-value timber manufacturing and products



Biobased manufacturing and products

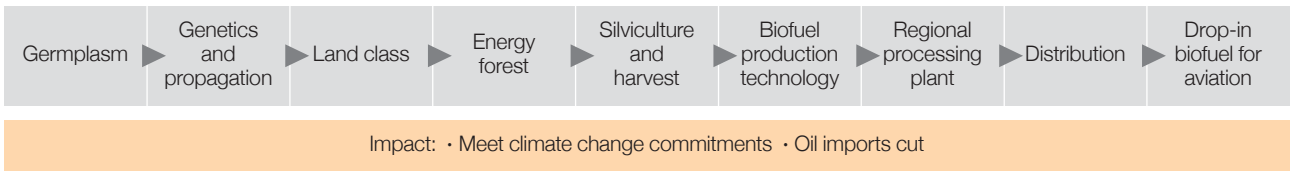


Figure 10: *Examples of the 'gene-to-product' value chain approach across the three impact areas.*

Prioritising our research

To help prioritise the research Scion will undertake to deliver its Strategy 2030, we have developed a strategic assessment model to evaluate the fit of proposed research with Scion's strategy. The model contains six strategic drivers, described in the table below:

Strategic driver	Description
Capability	We will ensure that Scion is at the forefront of science and innovation by focusing our activity in areas that are critical for the delivery of Scion's strategy or that support national capability. New activity should advance capability through targeted investment in people and infrastructure to ensure that we enhance our ability with others to deliver on our strategy.
Impact	Create impact for New Zealand that is measured by economic, social and environmental impact, through our policy or strategy advice, and/or technology transfer through partners and our science. Demonstrate the value Scion has achieved to a variety of audiences, including iwi, industry, government, public or international partners.
Innovation/creativity	Ensure our vision is enabled and progressed through creativity, agility in Scion's key themes and impact areas. Lead New Zealand at the frontier of science relating to a circular bioeconomy through demonstrated excellence in science and invention. Demonstrate connectedness through global and local collaboration with others to avoid reinvention and gain access to complementary skills.
Contribution to Māori	To enhance Māori futures through their unique resources, ensuring we create opportunities by building enduring Māori partnerships and driving co-innovations, using a Māori lens.
Great place to work	Enabling positive employment experience through practical and value-adding solutions that align with Scion's strategic direction and organisational imperatives.
Efficiency and effectiveness	Create a more effective organisation through improvements in processes, systems and infrastructure, while anticipating future organisational direction and consideration of best practice approaches, to deliver ongoing efficiencies.

Each programme will be scored against each driver (low, moderate, strong, extreme) to develop an aggregate assessment. Those assessments can then be cross-checked against other factors to stress test the prioritisation.

Additional assessments include prioritising the impacts right across our strategy and per research impact area and assessing research programmes against these priorities.

The entire process will identify programmes of research as ones that:

- are critical to delivery of impact,
- are important to maintaining core capability,
- should only be carried out if someone will fund them, and
- those that are not well aligned with our strategy.

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 is focussed 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. Regular review of Scion's investment portfolio will ensure delivery aligns to strategy and impact is maximised.

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, 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 29 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. Scion has been developing new partnerships across the forestry and wood processing value chain and creating opportunities for adding value to these partners. A key example is the work we are doing on our Ligate technologies (a fully biobased adhesive for wood panels) with New Zealand based partners. Other technologies continue to progress towards commercialisation including Woodforce (working with Japanese and New Zealand value chain partners), FA Modified Wood (working with partners in Europe), Biuret fertiliser (with a leading New Zealand fertiliser company) and a number of emerging opportunities.

To foster entrepreneurial thinking and lead to future innovator founders of new technology opportunities, we have kicked off 'Innovation Jumpstart', an internal accelerator programme. Working with internal and external mentors we are progressing five new ideas from idea to pitch leveraging pre-seed accelerator funding support from MBIE.

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 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.
- Creating 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 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 whole new approaches to undertaking science as well as creating step changes in potential outcomes. Scion will sustain active involvement in all these approaches either directly or through partnerships with other organisations.

Financials 2020 – 2025

Scion Group (New Zealand Forest Research Institute Limited)
Projected Income Statement for the Five Years Ended 30 June 2025

	2020 $000	2021 $000	2022 $000	2023 $000	2024 $000	2025 $000
Revenue						
SSIF	23,734	27,734	28,289	28,854	29,432	30,020
Other MBIE revenue	10,652	10,145	10,372	10,868	10,871	10,186
Commercial and other	21,671	23,211	26,330	30,577	33,487	36,328
Total revenue	56,057	61,090	64,991	70,299	73,789	76,534
Operating expenditure						
Personnel	29,664	31,514	33,910	36,889	38,771	40,368
Other operating costs	25,309	27,158	28,721	30,697	32,095	33,221
Total operating expenditure	54,973	58,672	62,631	67,586	70,866	73,587
Scion margin	**1,084**	**2,418**	**2,360**	**2,713**	**2,923**	**2,945**
Gain on disposal of fixed assets	714	0	0	0	0	0
Restructuring costs	(100)	(250)	(100)	(100)	(100)	(100)
EBIT-R*	**1,698**	**2,168**	**2,260**	**2,613**	**2,823**	**2,845**
Reinvestment						
EBIT	**1,698**	**2,168**	**2,260**	**2,613**	**2,823**	**2,845**
Net interest income/(expenses)	159	12	3	(42)	(125)	(100)
Profit before tax	**1,857**	**2,180**	**2,263**	**2,571**	**2,698**	**2,745**
Tax	(383)	(632)	(656)	(745)	(782)	(796)
Group profit after tax	**1,474**	**1,548**	**1,607**	**1,825**	**1,915**	**1,949**
Profit attributable to shareholders	**1,474**	**1,548**	**1,607**	**1,825**	**1,915**	**1,949**

**EBIT-R is EBIT before reinvestment*

Scion Group (New Zealand Forest Research Institute Limited)
Projected Consolidated Statement of Cashflows for the Five Years Ended 30 June 2025

	2020 $000	2021 $000	2022 $000	2023 $000	2024 $000	2025 $000
Cashflow from operating activities						
Cash received from operations						
Crown	34,386	37,879	38,661	39,722	40,302	40,206
Other clients	22,929	23,064	26,181	30,424	33,331	36,169
Interest	159	12	3	(42)	(125)	(100)
Total cash received from operations	57,474	60,955	64,844	70,104	73,508	76,275
Cash distributed on operations						
Personnel	29,242	31,680	33,924	36,902	38,782	40,376
Suppliers	20,232	21,220	22,604	24,331	25,417	26,364
Taxation	213	455	648	716	770	792
Total cash distributed on operations	49,687	53,355	57,176	61,949	64,968	67,532
Projected net cashflows from operations	7,787	7,600	7,668	8,156	8,540	8,744
Cashflow from investment activities						
Sale of fixed assets	714	0	0	0	0	0
Purchase of fixed assets	(12,096)	(9,243)	(7,623)	(10,495)	(10,095)	(4,830)
Purchase of intangibles	(98)	(150)	(150)	(150)	(150)	(150)
Net cash received/(disbursed) from investing activities	(11,480)	(9,393)	(7,773)	(10,645)	(10,245)	(4,980)
Cashflow from financing activities						
Increase in term debt	0	0	0	2,400	1,700	0
Repayment of term debt	0	0	0	0	0	(3,700)
Total cash disbursed on financing activities	0	0	0	2,400	1,700	(3,700)
Net increase/(decrease) in cash	(3,693)	(1,793)	(105)	(89)	(5)	64
Exchange rate effect	0	0	0	0	0	0
Opening cash balance	5,789	2,096	303	198	109	104
Closing cash balance	2,096	303	198	109	104	168

Scion Group (New Zealand Forest Research Institute Limited)
Projected Consolidated of Consolidated Balance Sheet for the Five Years Ended 30 June 2025

	2020 $000	2021 $000	2022 $000	2023 $000	2024 $000	2025 $000
Current assets						
Short term investments and cash	2,096	303	198	109	104	168
Debtors and accruals	7,338	7,485	7,634	7,787	7,943	8,102
Prepayments	869	869	869	869	869	869
Inventory	209	209	209	209	209	209
Total current assets	**10,512**	**8,866**	**8,911**	**8,974**	**9,125**	**9,347**
Less current liabilities						
Creditors and accruals	4,311	4,397	4,485	4,575	4,666	4,760
Personnel liabilities	2,975	3,035	3,095	3,157	3,220	3,285
Income in advance	3,532	3,532	3,532	3,532	3,532	3,532
Provision for tax	34	211	219	248	261	265
Total current liabilities	**10,852**	**11,174**	**11,331**	**11,512**	**11,679**	**11,842**
Net working capital	**(340)**	**(2,308)**	**(2,420)**	**(2,538)**	**(2,554)**	**(2,494)**
Investments						
Investments in subsidiaries and associates	241	241	241	241	241	241
Intangible assets	465	465	465	465	465	465
Total investments	**706**	**706**	**706**	**706**	**706**	**706**
Fixed assets						
Fixed assets	44,865	48,406	50,150	54,519	58,177	56,393
Biological assets	1,084	1,084	1,084	1,084	1,084	1,084
Total fixed assets	**45,949**	**49,490**	**51,234**	**55,603**	**59,261**	**57,477**
Term liabilities						
Provision for staff liabilities	1,241	1,266	1,291	1,317	1,343	1,370
Deferred tax liability	918	918	918	918	918	918
Term debt	0	0	0	2,400	4,100	400
Total term liabilities	**2,159**	**2,184**	**2,209**	**4,635**	**6,361**	**2,688**
Projected total net assets	**44,156**	**45,704**	**47,311**	**49,136**	**51,051**	**53,001**
Represented by						
Share capital	17,516	17,516	17,516	17,516	17,516	17,516
Retained earnings brought forward	24,950	26,424	27,972	29,579	31,404	33,319
Revaluation reserve	216	216	216	216	216	216
Current profit/(loss)	1,474	1,548	1,607	1,825	1,915	1,949
Projected closing shareholders funds	**44,156**	**45,704**	**47,311**	**49,136**	**51,051**	**53,001**


SCION
FORESTS PRODUCTS INNOVATION