Highlights of the Financial Year 2010/2011

Scion's purpose is to drive innovation and growth from New Zealand's forestry, wood products and wood-derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

Scion is New Zealand's leading Crown Research Institute in the following areas:

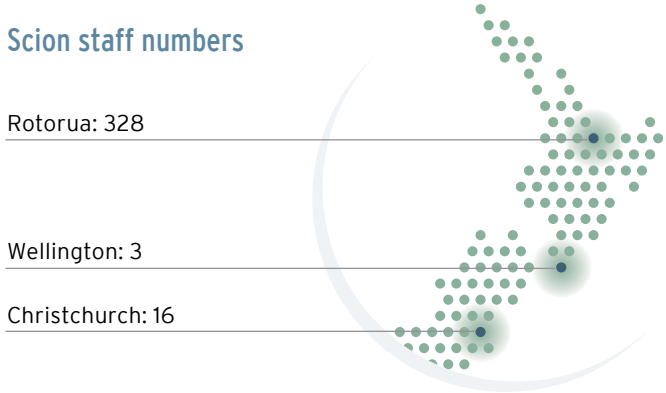
- Sustainable forest management and tree improvement.
- Forestry biosecurity, risk management and mitigation.
- Wood processing, wood-related bioenergy, waste streams and other biomaterials.
- Forestry and forestry-based ecosystem services to inform land-use decision making.

Through collaborations with other research providers and end-users, we also contribute to the development of:

- Land-based biosecurity, soil and freshwater management.
- Climate change adaptation and mitigation.
- Indigenous forestry.
- Industrial biotechnology and high-value manufacturing.

Scion at a glance

Scion staff numbers

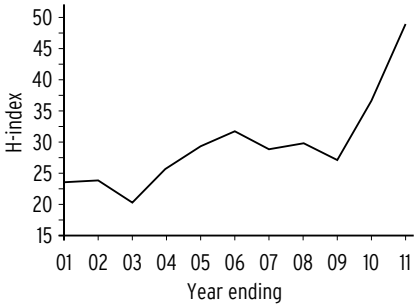


Operating revenue: $43.4m
Last year: $43.5m

Operating profit: $2.9m
Last year (before tax): 3.2m

Return on equity: 7.3%
Last year (before tax): 8.2%

Science publications



Scion provides high quality science that meets user needs in the short and long term.

Over the 2010/11 year Scion showed significant improvement in the number and success of peer-reviewed publications in high-rating journals.

CONTENTS

From the Chairman and Chief Executive

Defining changes have been made at Scion over the past 12 months in response to the Crown Research Institute (CRI) Taskforce recommendations and the institute's new Statement of Core Purpose.

Mr Tony Nowell
Chair

Dr Warren Parker
Chief Executive

Scion's strategy has been refreshed and its direction set out in a new five-year Statement of Corporate Intent (SCI). These changes have ushered in a positive new environment for the institute's science, and its relationship with and delivery to the forest industry.

Statement of Core Purpose and preparation of Statement of Corporate Intent

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

The strategic review and development of the SCI in line with this directive involved extensive consultation with the full spectrum of Scion's stakeholders – industry, Maori, government agencies and staff. Members of the executive and the Board met with more than 80 representatives across the forest industry supply chain to identify their science and technology priorities, and ways Scion can enhance its engagement with them.

This consultation gives us confidence that our new science and innovation framework captures the industry's requirements in a balanced way – both in terms of applied and strategic research, and between established and emerging sectors.

The forest industry is a strong driver of future economic growth

The macro global drivers for the forest industry are positive. World population growth, natural resource limits, the imperative to respond to climate change, and the rapid development of economies such as India and China, provide positive long-term demand for New Zealand forests and the products and services coming from them.

For example, the rapidly escalating world demand for renewable and low environmental impact chemicals, materials and energy is stimulating strong interest in woody biomass substitutes for petroleum-based products. And, limits on the use of water, and changes to global standards for packaging and consumer products are also generating impetus in bioproduct and bioenergy research.

Furthermore, the Emissions Trading Scheme (ETS) and development of carbon markets is encouraging the replanting of harvested forest stands and ensuring some new plantings. This is important because the storage of carbon in forests is a large element in New Zealand being able to meet its Kyoto commitments.

With these drivers in mind, Scion's assessment is that with focused effort, and well targeted research and development, New Zealand forest industry exports of $3.9 billion in 2010 can at least double and onshore economy activity treble by 2025. However, the circumstances for onshore processors, especially for solid and engineered wood, have been very difficult over the past 12 months due to the very subdued housing and construction market, high log prices and rapid appreciation of the New Zealand dollar.

This situation points to the need for on-going product and process innovation and the expansion of export markets, all areas in which Scion is well equipped to provide support to processing firms.

Solid financial performance despite slow economic recovery

The slow recovery of the New Zealand economy impacted Scion's financial performance with revenues of $43.4m being $3.0m behind budget (7%). However, cost containment enabled an operating profit of $2.9m (budget $2.6m) to be achieved. Extraordinary restructuring costs to right size and align Scion's capabilities, amounted to $0.5m (budget $0.2m). A pre-restructuring return on equity of 8.8% (budget 6.5%) was realised. Scion's balance sheet remains healthy with positive operating cashflows of $3.2m and cash reserves of $6.8m at 30 June. These reserves are committed to a multi-year reinvestment programme to upgrade Scion's infrastructure, strengthen its technology translation expertise and build staff capabilities .

Future direction built on strengthened engagement with industry and iwi

Looking to the future, Scion is committed to growing the quality of its engagement and value to the forest industry. The availability of core funding (some $17.7m) from 2011-12 will considerably aid in this task. Building enduring partnerships with Maori is especially important given their significant ($2b asset value in 2010) and growing interests in forestry. To support this aspiration, Scion will be establishing a rangatira group to advise the Board before the end of the current calendar year.

The Christchurch (and Japanese) earthquake tragedy visibly confirmed the resilience of wood-dominant buildings. The city's rebuild provides the opportunity to increase the use of solid and engineered wood. Scion will be working closely with the relevant stakeholders to ensure new wood product innovations, in many cases already used extensively overseas, are able to be used in the rebuild.

Increasing world oil prices, instability in major oil producing regions, the impact of the ETS and improvements in bioenergy technologies is reigniting interest from New Zealand firms in deriving energy products from trees. New Zealand's wood and pulp processing plants are already significant generators of energy from wood residues. By working closely with them, Scion can strengthen its leadership in renewable energy research and further evaluate the viability of 'drop in' biofuels for New Zealand's transport industry.

Delivering science for the benefit of New Zealand

Scion's new strategy focuses research effort into the six areas represented in this publication. As the highlights show, the past year has been very productive for the Institute's science and technology. The investment made by Scion and its partners have borne fruit through a number of commercial agreements with local and global manufacturing companies. These factors and stronger engagement with industry have laid the groundwork for an exciting future.

This document has been produced to complement Scion's Annual Report, which contains our full financial statements and reporting requirements. The Annual Report is available to view on www.scionresearch.com

Our strategy

The forest industry plays a vital role in building a stronger economy and achieving better environmental and social outcomes for New Zealand.

Scion has a proud heritage in providing the forest and material sciences necessary to underpin this success. Our research provides opportunities to meet current and future market needs in ways that do not harm the environment.

Scion's strategy focuses on delivering science and technologies in the following key areas:

- **Commercial forestry**
  Maximise the value and productivity of commercial forestry.
- **Wood products and processing**
  Improve the competitiveness of the solid wood processing industry.
- **Wood fibre, biopolymer and biochemical industries**
  Expand opportunities in the wood fibre, pulp and paper, biopolymer and biochemical industries.
- **Risk and adaptation**
  Improve New Zealand's preparedness for biosecurity incursions, fire and climate change.
- **Licence to operate**
  Ensure the New Zealand forest industry's licence to operate domestically and internationally and enhance environmental performance.
- **Bioenergy**
  Increase New Zealand's energy security through expanded utilisation of forest biomass.

Key achievements

Genetically impoved Douglas-fir seed from New Zealand was made available to growers for the first time
(see page 8)

A new wood plastic pellet technology has the potential to revolutionise the composition of plastics worldwide
(see page 13)

An unwanted caterpillar that defoliates trees and stings people is under attack from a new biological control agent
(see page 14)

A new pilot plant in Rotorua will test an innovative process for managing biosolid waste
(see page 16)

Thousands of people enjoyed a sunny day of science-related fun at "Science in the Park"
(see page 23)

COMMERCIAL FORESTRY

Maximise the value and productivity of commercial forestry

Mapping New Zealand's wood density

Density is a key property determining the stiffness and suitability of wood for end use so growers need to understand how it can be influenced. Scion scientists have produced a map of New Zealand that shows the wood density of radiata pine that can be expected on any given site in the country. Taking this tool to the next step, Scion has developed a growth model that can predict log density by site, with adjustments for age and stocking. Wood density is also a key factor in how much carbon is stored by a forest stand, making the model potentially useful within a carbon prediction and valuation tool.

The wood density model is derived from the most comprehensive dataset ever compiled in New Zealand from field measurements collected over many decades. Developed through the Future Forests Research (FFR) programme, the project is partly funded by the Radiata Pine Breeding Company.

Further to the work focusing on radiata pine, a model for predicting the wood density of Douglas-fir has been developed for the Ministry of Agriculture and Forestry. This model will be used to assist with calculating carbon yield tables for the Emissions Trading Scheme.

Focusing on Douglas-fir

Predicting the growth and yield of Douglas-fir has become easier for growers of New Zealand's second most popular commercial species. A growth model for Douglas-fir, known as the 500 Index, has been incorporated into Forecaster, a widely used software package that enables growers to manage their forests more effectively and to increase economic returns. This development, undertaken as part of the FFR programme, makes Forecaster a powerful planning tool for both radiata pine and Douglas-fir.

Genetically improved Douglas-fir seed from New Zealand was made available to growers for the first time. Seed orchards, established by Scion in partnership with the Douglas-fir Cooperative, (which now sits within FFR) have produced

their first commercial seed crop this year. Both orchards, from Canterbury and central Otago, will provide New Zealand growers with improved genetic stock from selected local progeny. The seed orchards were established in 2005 to fast-track the supply of treestocks that produce high stiffness wood.

Improving soil management

Understanding forest growth and productivity potential across New Zealand is an important aspect of optimising land use and ensuring sustainable forest management. Over the past year, Scion scientists have developed a provisional map describing soil carbon:nitrogen (CN) ratios for New Zealand from an extensive national dataset.

This achievement is a major breakthrough as CN ratio is an excellent indicator of site fertility. Applications for this C to N surface are likely to be many and varied within both forestry and agriculture. This study was funded by the Ministry of Agriculture and Forestry (MAF) under the Sustainable Land Management Mitigation and Adaptation to Climate Change programme.

Scion also completed a multi-year project with Nga Whenua Oranga this year, which involved soil and land use capability assessments at the farm scale. The aim of this project was to support the aspirations of the Maori landowners by transferring the knowledge generated in a manner that they could understand and use in their land management decision-making.

More efficient pine propagation

The primary means for deploying superior tree genetics is a biotechnology known as conifer somatic embryogenesis (SE). In 2010/11 Scion made significant progress in developing new SE protocols that improve the success rate of propagation.

Four main stages (culture initiation, multiplication, maturation and germination) are completed for SE before germinating embryos are available for nursery propagation. A major limitation of the technology has been a very low initiation rate of cell cultures. Scion's new SE protocols have lifted cell line capture from 11% to an average of 70%.

When the subsequent SE stages are similarly refined, the New Zealand forest industry will have a powerful tool for the commercial deployment of superior clones. This research was achieved with financial support from the Radiata Pine Breeding Company and external collaborators.

Advanced remote sensing for forestry

Forestry companies are increasingly interested in using LiDAR (Light Detection And Ranging) for management purposes. Scion scientists are exploring how forest managers can reap the benefits of LiDAR while keeping realistic about its limitations. A project, funded through FFR and Scion's Capability Fund, revealed exciting possibilities. Over the past financial year, Scion demonstrated that this technology provides opportunities for calculating tree heights, tree counts and maps showing within-stand variation in carbon stocks, stem volume and basal area. Conclusions from various studies suggest that, used correctly, LiDAR could enable a step change in forest mapping, inventory and information management.

In a separate but related project funded by the Ministry for the Environment, Scion has been exploring the feasibility of using LiDAR to estimate carbon stocks. In 2010/11, Scion confirmed that methods developed in the previous year for measuring Kyoto forest (i.e. post-1989 plantations) can also be applied to pre-1990 planted forest. In this project, Scion was also able to define the relationship between LiDAR metrics, leaf area index and carbon sequestration rates. These results will enable carbon stock change predictions to be made on a national level using remote sensing technologies, offering considerable cost savings in data collection.

SOLID WOOD PROCESSING AND PRODUCTS

Improve the competitiveness of the solid wood processing industry

Tools for improved timber processing

The ability for sawmillers to rapidly grade and segregate timber creates huge savings in wood processing costs. A new microwave-based grading technology developed jointly by Scion and Taranaki-based firm, Falcon Engineering, gives accurate moisture content readings on every piece of timber that passes through the mill. This information is useful for structuring loads into kilns so wet wood can be dried more uniformly and energy can be conserved on drier loads. Industrial trials for the moisture sensor have proven successful in the 2010/11 year and Falcon Engineering is now marketing the tool.

The long-standing partnership between Scion and Falcon Engineering also gave rise to the A-grader, an acoustic instrument for measuring wood stiffness. This technology has already proven its worth in many New Zealand and overseas sawmills. Further developments of the A-grader during the 2010/11 year have resulted in a successful "Mark 2" prototype, which includes the ability to measure stiffness more accurately along the entire length of a sawn board.

Wood drying goes under the microscope

Drying is a vital step in the wood manufacturing process that can substantially affect the value and performance of end products. Doctoral research completed by two Scion scientists provides fundamentally important knowledge for improving wood drying practices.

Dr Stefan Hill completed his PhD in Chemistry through Victoria University under Professor Sir Paul Callaghan. His project focussed on analysing the fundamental interaction between wood strength and water using synchrotron based X-ray diffraction and nuclear magnetic resonance (NMR) studies. He found that water molecules in the cellulose, hemicellulose, and lignin polymers of cell walls have an important structural and mechanical role in the dynamics of the cell wall. These functions also explain the role of water in changing the properties of wood when it is used as building material or in

composite products. This research will help in understanding the best way of drying wood and for predicting properties of wood in standing trees.

Dr Hamish Pearson was granted a PhD from Waikato University. His thesis was on the material properties and stress modelling of wood under high temperature, high humidity and force. Wood is a complex biological material that can distort during moisture exchange as a result of internal stresses. Hamish's research has enabled greater understanding of wood distortion by obtaining fundamental material property data for radiata pine at varying moisture contents and high temperatures. His study included the design of complex equipment to undertake experiments and combined the results into a 3D stress model. This work has been applauded as a much needed original contribution to wood science.

Savings achieved in mills

Wood processors can recover significant savings by adopting the findings of wood drying research undertaken for the industry consortium Solid Wood Innovation (SWI). Over the past year, Scion has completed a range of trials with successful outcomes for SWI stakeholders.

"One of the key R&D outcomes sought for the timber sector is an overall reduction in processing costs via increased efficiency, productivity and decreased consumption of process energy and water. The results from the in-mill research trials supported by SWI have demonstrated that substantial reductions in processing times and energy and water consumption are readily attainable with no impact on product yield and quality."

Chris Lafferty - Research and Development Manager, Forest and Wood Products Australia

Green technology for wood modification

Wood modification technologies enable softwoods to be used in new and exciting ways. A technology developed by Scion provides a novel way of giving plantation softwoods more stability, durability and hardness. It also allows colour change and options for forming shapes not easily achieved by wood. Over the past financial year, this process has undergone successful scale up trials using an industrial plant, representing an important milestone towards commercialisation. The green technology uses super-critical CO_2 to rapidly remove water from the wood, change its properties and deliver extractives products.

Discovering value in juvenile wood

Juvenile wood formed in young trees is a problem in fast-growing plantation species that are harvested at a young age. This wood is generally viewed by growers and processors as a low value product of inferior quality. Scion has entered a collaborative research programme with VTI in Hamburg to explore the cell wall characteristics of juvenile wood in radiata pine and Douglas-fir. This characterisation is a vital step in optimising the utilisation of juvenile wood in a range of manufacturing options. The International Mobility Fund (Germany - New Zealand) exchange programme brings together complementary skills and microscopy expertise to address an issue that is common to forest growers in both countries.

WOOD FIBRE, BIOPOLYMER AND BIO-CHEMICAL PRODUCTS

Expand opportunities in the wood fibre, pulp and paper, biopolymer and biochemical industries

New light on composites

An extraordinary lamp design by celebrated artist and furniture maker, David Trubridge, has drawn attention to the possibilities offered by new biomaterials. His lamp is constructed from a composite material developed specifically for this project using bioplastic (polylactic acid) and harakeke fibre (New Zealand flax). The new material, developed in a partnership between Scion and the Biopolymer Network Ltd, demonstrates the beauty and pliability of bioplastics combined with natural fibres. The lamp design, named Tipu, stands two metres in diameter. It was unveiled at the prestigious Hawke's Bay Invitational Art Exhibition and sold on the first night.

Commercialisation breakthrough for wood-plastic composites

A new wood plastic pellet technology developed by Scion has the potential to revolutionise the composition of plastics worldwide. Scion has negotiated a licensing agreement with Portugese-based wood processing company, Sonae Industria, for the manufacture and sale of the wood plastic pellet technology. The agreement gives the Sonae Industria Group an exclusive licence to commercialise the technology in Europe.

Scion developed and patented this technology under its biofibre research programme funded by the former Foundation of Research, Science and Technology (now Ministry of Science and Innovation). The technology enables production of wood plastic composites with long wood fibre reinforcement. This process provides an economical, consistent, natural fibre resource in high-density pellet or dice form. These pellets are easily fed into conventional extruders and injection moulders and processed as bio-based fibre reinforced plastics.

The main advantage of these new wood plastic pellets is the strength they give to traditional polymers. So much so, that Sonae Industria has named the technology's product "WoodForce". Applications for the technology are wide-ranging and could include decking, fencing, pallets, furniture, automotive parts, appliance housings, computer peripherals and many common applications for plastics and fibreglass products.

While the first commercial applications of the technology are likely to appear in Europe, the intellectual property is retained in New Zealand with Scion having filed international patent applications for the technology. In addition to the licensing deal for Europe, Sonae Industria has the right to negotiate with Scion for other regions except for Australasia, Japan and Korea.

"Scion is clearly a leader in research involving sustainably-derived biomaterials. Together with our expertise in both wood processing and commercialisation, we make a unique and powerful team."

Christophe Chambonnet – Chief Marketing & Sales Officer, Sonae Indústria.

Plastics from corn residues

Exciting new opportunities are opening up in North America driven by New Zealand technology company LignoTech Developments Ltd. Their focus is on transforming under-utilised residues that are arising in increasing volume from US bioethanol plants into new functional additives for plastics and bioplastics. Key to the LignoTech process are patented technologies for steam explosion, which they are developing in partnership with Scion. These commercially focussed projects are aimed at fully understanding the steam exploded residues and their functional attributes in plastics processing and associated moulded products.

RISK AND ADAPTATION

Improve New Zealand's preparedness for biosecurity incursions, fire and climate change

Biological control of urban forest pest

An unwanted caterpillar that defoliates trees and stings people is under attack from a new biological control agent released by Scion in January 2011. The gumleaf skeletoniser (*Uraba lugens*) is an Australian moth that has become an invasive pest in Auckland, Waikato, Coromandel, Bay of Plenty and Napier. In the past year, gumleaf skeletoniser was located in Nelson, which is the first record of this pest in the South Island.

A newly introduced parasitic wasp, *Cotesia urabae*, was released by Scion in Auckland as a biological control agent for gumleaf skeletoniser. Biological control has been a very effective and safe means of managing other eucalypt pests in New Zealand, reducing the need for chemical insecticides.

The wasp, which specifically targets the pest and lays eggs inside the caterpillar's body, was sourced from Tasmania (in collaboration with the University of Tasmania/Tasmanian Institute of Agricultural Research). Since the release, several cocoons of the wasp have been found in the field, indicating that the agent is establishing in its new environment. The successful release of the wasp was the pleasing outcome of a four-year biological control project, supported by MAF's Sustainable Farming Fund.

Cotesia urabae

Pictured at right Peter Berg (NZ Forest Owners Association President) with Ian Maxwell.

"Trees that provide shade and have become part of the Auckland landscape have suffered and died over the past 10 years. Until now we have relied on expensive treatments such as injecting trees and the removal of infested foliage. At best this has proved a stop gap measure. We are hopeful that biological control will help manage this pest."

Ian Maxwell - Manager of Parks, Sport and Recreation, Auckland Council

Science support for pest eradication

For pesticide applications aimed at pest eradication there is no margin for error. The treatment must effectively reach the target organism in all affected areas, while minimising costs and unwanted environmental and social impacts. Research by Scion assists operational managers with the complex decisions associated with pest incursions, building on the valuable experience gained in past eradication campaigns.

A key factor in meeting operational targets lies in the aircraft calibration procedure. In 2010/11 Scion developed new protocols for aircraft calibration that will improve the chance of success in future eradication campaigns. The calibration process is designed to ensure that the specified pesticide dose is efficiently distributed across the target area at minimum cost. The new calibration protocol is available to MAF for use in future incursion responses. This important outcome, which was funded through the Better Border Biosecurity collaboration, was achieved by analysing actual data from the salt marsh mosquito eradication programme in Hawkes Bay in 2008.

Adaptations for healthy forests

Predicting the likely impacts of climate change on plantation forests is seen as an important step towards risk management and adaptation. A large research programme funded by MAF is aimed at modelling the direct effects of changes in environmental conditions on tree growth, and indirect impacts caused by changing wind, fire and disease risks. Improved understanding of environmental drivers will ultimately help managers to make informed decisions on future siting of plantation species or management of existing species.

Helping New Zealand rural fire agencies to understand changing risks was the focus of two major fire climatology analyses completed during 2010/11. One provided an improved description of current fire climate severity across the country that will be used to support the definition of boundaries for proposed enlarged rural fire districts. The second analysis, conducted as part of a MAF-funded Sustainable Land Management Mitigation and Adaptation to Climate Change project, provides updated estimates of the effects of climate change on future fire danger. The study confirmed the potential for increased fire risk in eastern areas where fire risk is already elevated.

Insights into worker safety and productivity

A doctoral study completed by Scion researcher Richard Parker provides a unique glimpse into the work patterns of people in dangerous occupations. The human factors researcher developed new ways of measuring workers' activities using wearable video cameras and sensors. This technology provides a unique approach to gathering data about what workers are doing, where they are doing it, and how hard they are working at the time (i.e. heart rate). The technology was combined with reflective interviews that provide a deep understanding of why workers approach tasks in the way they do. This research has provided valuable insights into the work of tree fellers and rural fire fighters that will improve productivity and help to prevent injuries in these high-risk activities.

LICENCE TO OPERATE

Ensure the New Zealand forest industry's licence to operate domestically and internationally and enhance environmental performance

New waste conversion technology

The Minister for the Environment Hon Dr Nick Smith opened a pilot plant in Rotorua that will test an innovative process for converting biosolid waste into valuable chemical products. The pilot plant uses thermal deconstruction to "cook" the biosolids (sewage sludge) and break them down into re-useable chemicals and other by products. These chemicals can be used for fertilisers or in the production of bioplastics and biofuels.

This technology arises from a research project involving Scion and the Rotorua District Council, who joined forces in 2008 to develop a new approach to the management of organic waste. The pilot plant will initially operate for 12 months. Depending on the results, the next stage will be to construct a demonstration plant, sized to handle all of the biosolids from Rotorua's Wastewater Treatment Plant.

Rotorua District Council sees the potential of the technology to not only improve its waste disposal processes but to provide a revenue source from the converted waste. Rotorua has approximately 8,500 tonnes of biosolid waste going to landfill every year at a current cost of approximately $920,000. This project has the potential to further reduce all organic waste sources going to landfill including those from wood and fibre processing.

The technology was originally developed through a programme funded by the Foundation for Research, Science and Technology (now the Ministry of Science and Innovation). In 2010 the Ministry for the Environment committed to an investment of up to $1 million over two years, under its Waste Minimisation Fund, to support further development of the technology.

"Biosolids or sewage sludge generated by sewage treatment is a big problem for councils around the country due to the large volume and hazardous nature of this waste. That's why this thermal oxidation technology developed by Scion is extremely important to help reduce organic waste going to landfill as well as cutting our greenhouse gas emissions."

Hon Dr Nick Smith – Minister for the Environment.

Pictured from left: Kevin Winters (Rotorua Mayor), Hon Dr Nick Smith and Tony Nowell (Scion Chairman).

Expanding scope for lake restoration

Improving lake water quality is a challenge for most regions of New Zealand. Successful lake trials of a modified mineral (zeolite), developed by Scion, Blue Pacific Minerals and the Bay of Plenty Regional Council to reduce nutrient impacts, have lead to commercial expansion of the product. During the 2010/11 year, Scion entered an exclusive licensing agreement for modified zeolite with Blue Pacific Minerals. The Tokoroa-based manufacturer is now working to scale up production to provide suitable volumes for lake treatment applications by the Bay of Plenty Regional Council. The product is being marketed as Aqual-P.

In February 2011, the Regional Council used Aqual-P to treat an algal bloom threat in Okawa Bay on Lake Rotoiti. Council staff and residents observed a rapid improvement in water quality and the algal bloom did not become a serious health issue.

Reducing fumigation at ports

Enhancing market access while reducing the use of methyl bromide as a fumigant for exported goods is the focus of a group known as Stakeholders in Methyl Bromide Reduction (STIMBR). Scion supported STIMBR in its successful funding application to the Primary Growth Partnership to support increased research in this important area. Scion is a large contributor to this project with research aimed at reducing fumigant release to the atmosphere, identifying alternative chemicals and developing non-fumigant approaches to risk management.

An early outcome of related research has reduced fumigant use by demonstrating that fumigated goods do not necessarily require re-treating if they are delayed at the port, provided critical parameters are accounted when making decisions. At present, if goods are fumigated and left for 36 hours they have to be retreated at significant expense. As a result of Scion's recommendations on critical parameters, MAF has modified its requirements and reduced the need for additional treatment.

Achieving compliance in herbicide use

Weed control is the single biggest establishment cost in New Zealand plantation forests. Without it new forest plantings struggle to get started. Therefore, retaining cost-effective weed control is a major challenge to the plantation forestry sector due to compliance issues associated with Forest Stewardship Council (FSC) certification.

To support the industry's commitment to addressing herbicide issues, Scion completed an in-depth review of chemical and non-chemical weed control regimes. Results showed that the use of weed mats, manual, and mechanical control would be too costly and, also, unsuitable for many sites in New Zealand. The study concluded that it would not be economically viable for forest growers to avoid the use of herbicides altogether and points to the importance of developing cost-effective compliant herbicide, and non-chemical, options for growers. This analysis has been published in the *Canadian Journal of Forestry Science*.

Measuring footprints on the environment

Environmental issues have assumed an escalating importance for government, businesses and consumers alike. Life Cycle Analysis (LCA) is the pre-eminent technique to quantify environmental issues like carbon footprints. In the 2010/11 year, Scion completed an LCA of the new Arts and Media building at Nelson Marlborough Institute of Technology (NMIT). The multi-storied building is a world first for both its timber earthquake resistance design and its unique laminated veneer lumber (LVL) primary structure. The purpose of the LCA was to compare the energy consumption and the carbon footprint of the NMIT building over its complete life cycle, spanning 60-100 years. Results of the LCA demonstrated that the existing timber structure reduced greenhouse gas emissions around 8% compared with concrete and steel constructions using the same design.

During the year, Scion undertook several other LCA projects to determine the footprints of LVL, wood-ethanol, diesel, kraft pulp and tissue paper. These LCA studies are providing insights concerning environmental efficiency and can be used to evaluate technologies in the associated supply chain.

BIOENERGY

Increase New Zealand's energy security through the expanded utilisation of forest biomass for energy

Torrefaction creates biofuel opportunity

A thermal treatment technology called torrefaction has been adapted and refined by Scion to create a light, energy dense fuel product from radiata pine that has a range of potential applications in industry. Torrefaction removes water and wood volatiles to produce a solid, dry material that has about a third less mass while retaining 90% of its energy content, thereby reducing transportation costs and overcoming supply and storage problems associated with firewood and wood pellets.

Scion's focus on torrefaction of New Zealand's radiata pine reflects growing world-wide research interest in this technology. Torrified biomass can be used in large-scale coal-fired power stations or in smaller coal-fired heat plant as a replacement to burning coal – thereby reducing CO_2 emissions. It can also be condensed into pellets and used in home heating like existing wood pellets (albeit with a much higher energy density).

Government recognition for forestry biofuel option

A report published by the Parliamentary Commissioner for the Environment in July 2010 recognised the opportunities for forest-derived biofuels identified by Scion in the Bioenergy Options for New Zealand project completed in 2009/10. Results from this project demonstrated that woody biomass from plantation forests offers the only renewable resource of sufficient potential volume to supply biofuels on a national scale. Scion's analysis of wood supply using geographical information systems (GIS) forms one of the major appendices to the Parliamentary Commissioner's report.

Biofuels from forests

In New Zealand, forests offer a significant opportunity for large scale production of biofuels to replace fossil fuels. A pre-treatment process for radiata pine has been developed by Scion to improve the enzymatic conversion of softwood into sugars. These sugars can be used as feedstocks for the production of biofuels such as bioethanol, biobutanol and hydrocarbons. In pilot-scale trials, Scion has achieved a 79% recovery of fermentable sugars from the pre-treated softwood. The first sugar syrup arising from this process is undergoing trials in the UK with a partner who has a proprietary microbe producing biobutanol.

This research is being carried out as part of the New Zealand Lignocellulosic Biofuel Initiative programme. The aim of this multi-agency programme is to demonstrate that biofuels and lignin co-products can be produced from softwoods in a cost-effective and environmentally sustainable manner. Research at laboratory and pilot-scale is being used to model the economics of a 90 million litre per year commercial bioethanol facility in New Zealand. The partners in this programme include Beca AMEC and the United States Department of Energy Joint Bioenergy Initiative.

People and connections

Delegates at the Biofuels Science Symposium.

The New Zealand forest industry operates in global markets. To remain competitive it must access and adapt the latest technologies, and secure intellectual property in emerging market areas as quickly as possible. Scion plays essential roles in connecting and linking firms, and in forming large multi-disciplinary teams to discover new solutions.

National and international collaborations are required to assemble teams with sufficient scale, experience and resources to tackle these big challenges and opportunities. Scion demonstrates real strength in leveraging international networks to build these collaborations, enabling knowledge sharing and capability building for the benefit of New Zealand. Highlights of the 2010/11 year include:

- Transferring research between the European Union, Australia and New Zealand is enabling greater global understanding of forestry and climate change. These collaborations are enabled by the European Union International Research Staff Exchange Scheme (IRSES), under the "TRANZFOR" programme. During the 2010/11 year Scion participated in 18 scientist exchanges. Among the seven scientists who visited Scion was Dr Hugh Evans, who is the head of Forest Research in Wales. The strengthening relationship between Dr Evans and Scion has resulted in his appointment to Scion's newly formed Science Advisory panel.

- The development of next generation liquid biofuels and co-products was the focus of Scion's inaugural Biofuels Science Symposium in December 2010 (pictured above), supported by the Ministry of Science and Innovation and the Ministry of Foreign Affairs and Trade through the Science Promotion Fund. The purpose of the symposium was to bring together science experts from New Zealand and overseas to strengthen collaborative networks in biofuel development. This event led to the establishment of a group called the Advanced Biofuels Research Network, aimed at maximising collaboration between New Zealand research providers.

The development of meaningful solutions to complex problems requires the focus of strong science teams comprised of talented individuals. Over the 2010/11 year, 14 Scion staff were recognised through a range of awards and scholarships. Highlights of these awards include:

- Cathy Hargreaves, a scientist in Scion's tree breeding and propagation team, received a funding award under the 2011 Dumont d'Urville Science and Technology Programme. The award has enabled Cathy to advance her research focusing on novel technologies to propagate conifers through international collaborations with researchers at two French forest research organisations (INRA and FCBA). The funding will facilitate the reciprocal visits of two Scion scientists and one from each of the French institutes over the next two years.
- Fibre processing scientist Ian Suckling was recognised for his on-going contribution to Appita – the technical association that represents the Australian and New Zealand Pulp and Paper Industry. Ian was presented with the Appita Oertel Nadelbaum Distinguished Service Award for 2010.
- Senior scientist Dave Cown received a Distinguished Service Award from the International Union of Forest Research Organisations (IUFRO) for his contribution to forestry sciences spanning over 40 years.
- Five Scion staff completed PhDs during the 2010/2011 year, Dr Stefan Hill (wood chemistry), Dr Richard Parker (human factors), Dr Hamish Pearson (wood drying), Dr Jeff Seadon (waste management) and Dr Mohammed Sohel (energy production). Stefan Hill is pictured with his supervisor, Professor Sir Paul Callaghan.

Cathy Hargreaves was awarded funds to support collaborative research in conifer propagation.

Ian Suckling was recognised for services to the pulp and paper industry.

Professor Sir Paul Callaghan and Dr Stefan Hill.

Professor Sir Peter Gluckman (Science advisor to the Prime Minister) visited Scion in September 2010.

Developing Maori scientists

A partnership between Scion and Nga Pae o te Maramatanga has created a valuable opportunity for Maori science students to gain work experience, while assisting Scion with projects at the interface of Maori knowledge and science. Anastasia Rickard (Ngati Pikiao, Ngati Te Takinga, Ngati Porou, Ngati Koata) worked on a project to develop a model riparian area in the Rotorua area to meet a range of community, cultural and environmental aspirations. Anastasia is studying towards a Bachelor of Science degree with Otago University, and is one of four Maori students supported by Scion this year.

Corporate social responsibility

Scion provides sponsorship for community and staff activities, with a particular focus on opportunities to promote science. During 2010/11, Scion sponsored 30 events covering a range of activities from local sporting events to providing awards and scholarships.

- Timber Design Awards – 2011 marked the 12th year that Scion has sponsored awards at the University of Auckland School of Architecture and Planning. Winners for three awards selected for their innovative use of timber in design were Bachelor of Architecture students, Ran Xu, Shiqi Lin and Ray Lee.
- Suffrage Centennial Scholarship – Scion awarded the 2010 Suffrage Scholarship to Rotorua Girls High School student Alivea Smith. Alivea received $2000 towards her university studies and a contract for summer vacation work.
- Christchurch Agricultural and Pastoral Association (A&P) show – Christchurch enjoyed a record turnout at their annual A&P show despite disruptions caused by the September earthquake. Scion's stand, which was aimed at raising the profile of science and advising on career opportunities, attracted high public interest and was awarded the Best Indoor Trade Site at the show.

Science in the Park

Strawberry DNA, plastic rockets and liquid nitrogen were used to bring science alive for the community at Scion's biennial open day.

Thousands of people from the Bay of Plenty and beyond enjoyed a sunny day of science-related fun at "Science in the Park" in March 2011. A total of 2,786 visitors were counted at the free event which aims to create a greater local awareness of Scion and its activities.

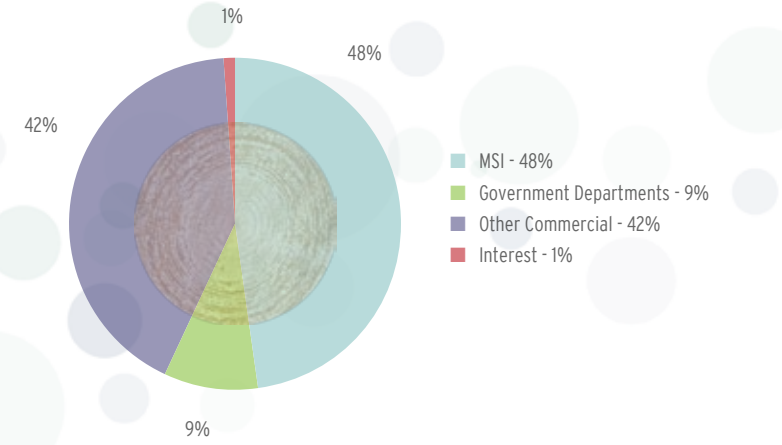
Interactive displays and activities created by staff demonstrated how science and technology directly benefits the community.

Financial summary

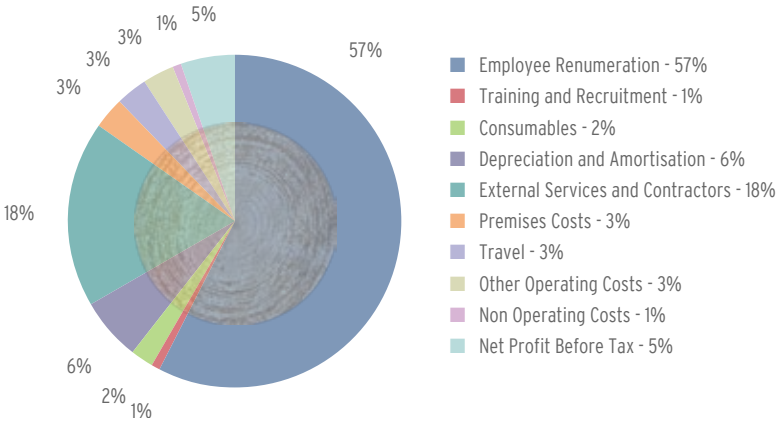
	2009 Actual	2010 Actual	2011 Budget	2011 Actual	2012 Budget
Revenue, $m	43.97	43.49	46.20	43.35	45.70
EBIT, $m	3.00	3.08	2.44	2.60	1.77
EBIT Margin	6.8%	7.1%	5.3%	6.0%	3.9%
EBIT-R, $m	3.37	3.44	3.12	2.94	2.84
EBIT-R Margin	7.7%	7.9%	6.8%	6.8%	6.2%
Total Assets, $m	37.36	36.35	37.44	37.70	38.77
Return on Equity	9.2%	-3.9%	6.0%	7.3%	4.9%
Equity Ratio	71.4%	68.3%	73.7%	67.6%	68.4%
Dividend, $m	1.500	1.109	-	-	-
Gearing	0.0%	0.0%	0.0%	0.0%	0.0%

Revenue: Includes science research, contract work for government and commercial clients, royalties and licence fees.
EBIT: Earnings before interest, tax and restructuring costs.
EBIT Margin: EBIT ÷ revenue.
EBIT-R: EBIT before reinvestment where reinvestment are amounts approved by the Minister.
EBIT-R Margin: EBIT-R ÷ revenue.
Return on equity: Net profit after tax ÷ average shareholders' funds, expressed as a percentage.
Equity ratio: Average shareholders' funds ÷ average total assets.
Gearing: Financial debt ÷ financial debt plus shareholders' funds.
(The Minister of Finance and the Minister of Science and Innovation each hold 50% of the shares on behalf of the public.)

Our revenue



How our revenue is spent



Company directory

Board of Directors

Mr Tony Nowell (Chair)
Ms Alison Andrew (Deputy Chair)
Mr Peter Berg
Mr Sheldon Drummond
Mr Chris Insley
Dr Brian Rhoades
Mrs Judith Stanway

Executive Management

Dr Warren Parker
Chief Executive

Dr Elspeth MacRae
General Manager – Science
(Bioproduct Development)

Dr Brian Richardson
General Manager – Science
(New Forests and Forest Science)

Dr Trevor Stuthridge
General Manager – Science
(Sustainable Design)

Dr Russell Burton
General Manager
– Research and Investments

Ms Chelydra Percy
General Manager
– Corporate and Business Development

Mrs Keri-Anne Tane
General Manager
– People and Performance

Mr Rob Trass
Chief Financial Officer

Registered Office
Te Papa Tipu Innovation Park
49 Sala Street, Private Bag 3020, Rotorua 3046, New Zealand

Contact Details
Scion Head Office
Te Papa Tipu Innovation Park
49 Sala Street, Private Bag 3020, Rotorua 3046, New Zealand
Telephone: +64 7 343 5899
Facsimile: +64 7 348 0952
Email: enquiries@scionresearch.com
Website: www.scionresearch.com

Wellington Office
Equinox House
Level 6, 111 The Terrace, Wellington 6143, New Zealand
Telephone: +64 4 472 3283

Christchurch Office
University of Canterbury
Forestry Road
PO Box 29 237, Fendalton, Christchurch 8450, New Zealand
Telephone: +64 3 364 2949
Facsimile: +64 3 364 2812

Commercial Businesses
Te Papa Tipu Innovation Park
49 Sala Street, Private Bag 3020, Rotorua 3046, New Zealand

ATLAS Technology
NZ Freephone: 0800 786 285
Facsimile: +64 7 343 5679
Email: software.support@atlastech.co.nz
Website: www.atlastech.co.nz

Veritec
Telephone: +64 7 343 5899
Facsimile: +64 7 348 0952
Email: enquiries@scionresearch.com
Website: www.veritec.com

ISSN 1179-4178 (print version)
ISSN 1179-4186 (online version)

Printed on 9lives paper. Every purchase of 9lives paper is recorded, and for every tonne of paper sold, Spicers Paper donates $20 to WWF-New Zealand projects that help protect our unique environment.