Ministry of Business, Innovation & Employment

National Science Challenges

Great NZ Science Project

Analysis report

The views expressed in this publication are those of the author and are not necessarily supported by the Ministry.

Contents

How to use this summary

This document summarises the public submissions and comments received through the Great New Zealand Science Project (GNZSP) website developed for public engagement for the National Science Challenges.
www.thegreatnzscienceproject.co.nz

The campaign started on 11 November 2012 and the deadline for inclusion in this summary was 28 January 2013.

A set of illustrative challenges was developed by a cross government agency group following a series of workshops of government agencies, to give people an idea of what a National Science Challenge might be like. These illustrations were used to elicit thoughts and suggestions from the public, by asking them to 'post' their submissions on different pages of the website. The public was also invited to make suggestions that were not necessarily related to the illustrative challenges, and are grouped in the 'Other Ideas' section. The GNZSP site received 138 submissions all of which are referred to in this summary. In addition, a large number of 'enabled' comments (420) plus further comments on other ideas were received, some of which are mentioned in this summary. Some postings by the public to the site were 'disabled' because they were 1) testing (no real content), 2) inappropriate or obscene or 3) duplicate entries.

In addition, a replicate site was made on the Ministry of Science and Innovation (MSI) webpage for people who could not access the GNZSP site. This let people 'vote' for one of the illustrative challenges, or make a comment / submission for a different potential challenge. This received 227 submissions, the last of which was "*This needs to be extended through Feb, so that schools can really get involved*." The website will remain live until at least 31 March 2013, for discussion and use, but submissions are closed.

The complete submissions for each Challenge are captured in a set of worksheets in the GNZSP Excel file (sent to Peak Panel members). Identity numbering can be used to match references in this summary with individual submissions in the Excel file.

There were three sets of spreadsheets that came out of the Great New Zealand Science Project and one from the MSI site:

–submissions – what people thought should be challenges grouped by illustrative challenge set, plus new ideas (other) that didn't fit in to the illustrative challenges n=138 [ID tags beginning with an S]

–comments (on submissions) n=429 [relevant comments only are included in the summary; ID tags begin with a C]

–comments on Other Ideas (these were discussion threads arising from people's submissions, comments or other ideas). N=186 [relevant comments only are included, ID tags begin with the letter I]

–MSI site submissions – this site let people 'vote for' the ones they liked, as well as suggest other ideas n=227 [ID tags begin with M]

Additional discussions were held via various social media sites including a GNZSP Facebook page and Twitter, and those were not analysed systematically for this summary.

All information (except disabled postings) is being provided to the Peak Panel to inform its selection of a set of National Science Challenges from all the survey, science sector and GNZSP submissions. Their recommended options will be presented to Cabinet for a decision in April 2013.

Advanced materials and manufacturing

Advanced materials and manufacturing	The submissions in the advanced materials area spanned a range of areas.
	• Advanced materials – polymers, composites, metals; multiple applications [S78] – but check with industry first to ensure there's a market or not an existing solution [C138]; alternatives to traditional materials/methods for manufacturing [C180]
	• Beat the tyranny of distance with light materials and licensing of technology [C296, C163].
	• Small scale manufacture and rapid prototyping –self-sufficiency as a necessity [M13]
	• Technologies relevant to 3D printing and desktop manufacture [M196; C417]
	• Robotics – multiple applications e.g. micro robotics in health, aerial drones for environmental monitoring [S4], [I184, I185]
	• Biological materials e.g. construction materials from wood / grown products [M9, C397]; Biofuels – renewable source of transport fuel [S16]; collagen-based nanofibres [C416]
	• Green tech to mitigate global warming [S68; M69]; cold fusion [C380]
	• Waste recycling / element recovery (Zn, Cu, Pb, etc.) [S37] zero-waste / use recycled materials in manufacturing and building [M165]; recycling food waste; develop exports of recycled materials [S79]; new materials for recyclable or degradable packaging and products [C26, C17, C101, C163];
	• Biodegradable advanced materials for goods [C17]; Plastic that biodegrades in short time frame (weeks not years); [M15]; plastic-eating microbes that can

function in range of environments (sea, bird gut) [M198]

- Electro mechanical (flexible membrane / polymer) materials and associated electronic circuitry for control. Applications = undulation propulsion (water / air) or renewable power generation (e.g. from wind) [S31].

- Next generation of photovoltaic materials [C70], solar panels made in NZ [S81]; enable off grid solar / wind energy; a roofing tile that generates electricity [C256]; increase efficiency of photovoltaic cells or reduce their manufacture costs to make cost effective. [S40, C70]

- Silica to silicon – establish the commercial quantities of the various purities so as to develop a range of commercial opportunities around production of silicon metal in NZ [S50]

- Nanotech – graphene; to make it efficiently (low heat wastage and low price); use for power savings and to sell overseas [C257; C401].

- Develop endurance airships – multiple transport and research uses [S80]

- Invent a teleporter [S67]

- New materials to capture kinetic energy from the environment (e.g. flooring) to make electricity (e.g. walking [S82])

- Innovation system to develop research discoveries; shared IP; business grants [S77]
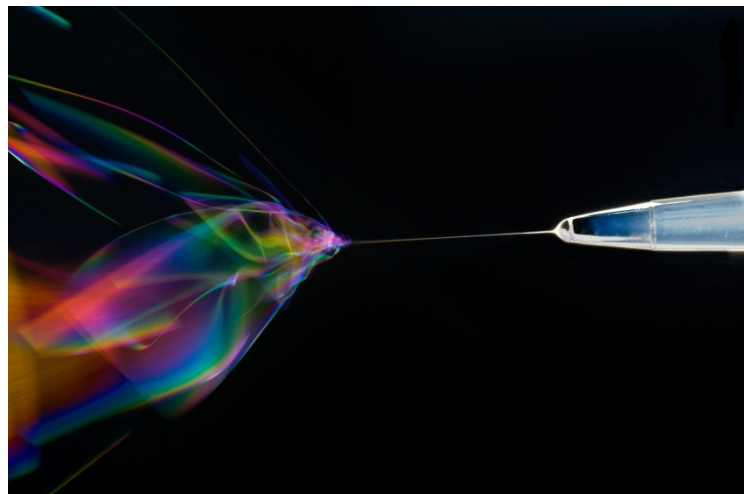
The rainbow effect that happens when collagen fibres are 'electro-spun" to draw nano-sized fibres, 500 times thinner than human hair. Photo: Robert Lamberts, Plant & Food Research.

Comments and ideas:

- o The comments and ideas submitted to the GNZSP site in this area were generally around: energy and robotics, energy self-sufficiency, use of alternatives such as biofuel from algae or photovoltaics. One pointed out there was a reason the 'crazy' ideas hadn't come to market yet (magnetic energy, splitting water to store energy in hydrogen etc.) – and that's because they are not viable options or worth it (yet). However, there was a strong theme that people thought advanced materials could, and should, be used to transit away from fossil fuels.

- o Other comments included notions of HOW we should pick research to do, and some ideas on WHAT we could work on, (e.g. implantable medical devices). Those that are not repeated above were:

- o More advanced manufacturing materials and processes to give us competitive edge [C74, C283, C297]

- o Biomimicry: develop carbon-based, sustainable, non-toxic materials [C69]

Website & Facebook snapshot

| Websites – GNZSP & MSI	
Supporters	459
Submissions	15
Comments	45
Youtube views	223
Facebook	
Comments	38
Likes on posts	196

Foods for health

Foods for health	The submissions under Food for Health were:
	• Science-based diet [S27] – get back to paleolithic nutrients and calorific levels to reduce risks of obesity, cancer, diabetes, heart diseases, neurodegenerative diseases, depression and infertility. Research on foods for health should not crowd out the big issues of poor diets; e.g. the 'exercise recovery properties of blueberries' is interesting sports science but we need public health messages based on the evidence collated to date (e.g. eat less meat; eat more fruit and vegetables) rather than more 'super foods'. Back to basics on good natural foods [M137; C213; C386] • Research on attributes of foods that make them healthier than other examples of the same food – e.g. soil microbes [S87] soil quality [C404]. • Research on how the human body assimilates nutrients, and the best way to help the body extract the right nutritional value [C264] • Biotechnology – Genetic modification of current food crops to yield more efficient food for the increasing world need; drought resistance, water efficient, less allergens, etc. [S9] • Synthetic food [C384] • Sustainable intensification based on socio-ecological rather than monetary paradigms [M15]; respect and care for farm animals [M118]; • Ensure bee survival as they are our main pollinators [C385; C403;] • Research ways to influence consumer choice to healthier foods [S22], – e.g. traffic

light labelling of foods, tax on unhealthy food [S47]; stop advertising junk food on TV; education to increase food growth at home [S25];

- A blue revolution – aquaculture the future of farming [S134]

- Food authenticity and fraud (NZ product traceability and enforcement overseas) [M56]; validated health products and food safety [C421]
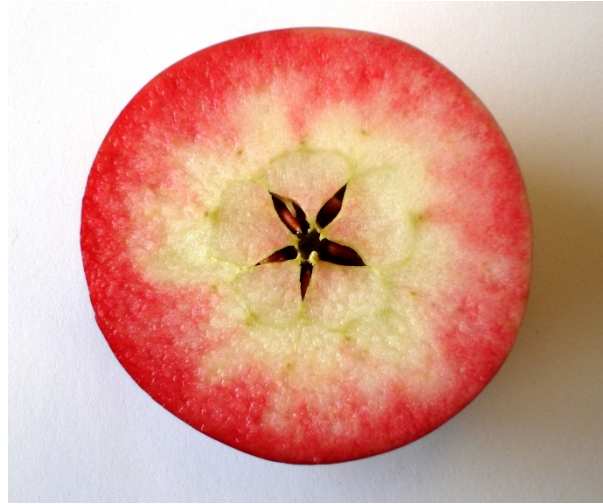
Developed by pip fruit breeders at Plant & Food Research, this red-fleshed apple is packed with health-promoting antioxidants.

Comments and ideas:

  o The comments and ideas submitted under this challenge mainly focused on nutrition and genetically modified organisms (GMOs). Comments were for and against GMOs; and on the potential for NZ to have a 'niche' market in organic food production and/or GM free food production).

  E.g. "*We don't need GE food we need fairer global distribution of food. Which is not a science issue, but a policy issue.*"

  o The long discussion threads and numbers of comments showed that people related well to this Challenge. (Interestingly for the most popular area, comments included a few that were pseudoscience and misinformation.) While some expressed excitement about what science could do for healthy foods, many comments were in relation to obesity, health impacts of diet, genetically modified (GM) foods, and getting back-to-basics versus fancy-foods, including growing your own. This encompassed a strong theme of

better health by eating more plant food, rather than meat and processed foods. Some comments said there was little 'science' could do, it was mainly an education/policy issue.

o The most pressing problems are not scientific at all, but are social [C333] good science cannot make up for bad food (choices/policies).

o Science could focus on human gut microbiome [C333].

o Chemicals and food [C353]; "*My hypothesis is that natural food with a minimum of scientific 'improvement' is ultimately the healthiest food*" [C264]; washing and storing [C244]; homemade, organic, non-processed food [C5; C32; C48]; harm from agrichemicals [C247]; food components such as hydrogenated oils [C35]; make NZ an organic country -.work on technology required to produce high quality organic, non GMO, foods for premium markets overseas [S72]

o There's more information about foods than a consumer can handle [C77], and mixed messaging, e.g. Beef and Lamb industry body says 'eat meat', 'Forks Over Knives' movie says 'don't eat meat' [C238].

o 'Foods for health' is important, given our levels of heart disease, cancer etc. from eating bad foods. However, there needs to be political will to apply research results – promotion, pricing, regulation etc. [C249]

Website & Facebook Snapshot

Websites – GNZSP & MSI	
Supporters	471
Submissions	8
Comments	72
Youtube views	306
Facebook	
Comments	417
Likes on posts	1,448

Fighting disease

Fighting disease	This topic was the most popular for most of the campaign, and 'creating cures' captured the imagination of the public as a desirable thing, although there was a strong sense of preventing illness first (mainly through good diets). • Pharmacology and toxicology – multiple applications across illnesses [S10] • Treatments for neurological diseases; [S21] focused brain research collaborations across NZ [S46]; genetic factors of brain degeneration, critical environmental factors, getting drugs in to the brain, stroke treatment, - fight diseases that affect older people (and all people) • A cure for diabetes [C91]; create a synthetic pancreas [C62]; education about healthy diet and risks of poor diets [C102]; nation-wide test for diabetes [C123] • New vaccines & antibiotics to fight MRSA, outbreaks of E. Coli, etc.[S56]; microbial research [C419; S39] • Microbes – improved gut microbes [S84]; better understanding natural immunity [C418] • Create a sunscreen that absorbs the good rays and avoids the harmful rays [C189] • Find out prevalence of lung cancers from somatic mutations in genes such as EGFR, ALK, ROS-1 and RET; develop drug therapies for these. [S42] • Analyse the risks from environmental factors (such as chemicals used in modern food production) on brain disease and insulin-resistance etc. e.g. 90% of

fungicides are carcinogenic [C237, C233];

- Determine risks of varroa mite control chemicals resulting in mite immunity - test organic alternatives; need to improve bee health [S117].

- Research into mental health treatments [M113, M114, M135] that are alternatives to simply sedating patients [S24];

- Personalised medicine and data system: set up system to collate patient data from GPs, to better understand diseases and factors: include banks of samples /identified viruses genetic data; make available from GP database to scientist (anonymised) [S13] and use to identify people to offer trials/personalised medicine [S83]; tissue banking for personalised medicine [S85]

- Study older healthy people's lifestyles to find common factors that improve health [C420]

- Bioprospecting for medicines – e.g. lichen [M206, C260]

- Oral health [M5]

- Anti-cancer drugs; NZ trials [S41; M161];

- NZ support 'big pharma' reduce regulation/compliance [S73] (this submission was more strongly worded, and probably sarcastic);

- Better support for intelligent, but inexperienced scientists [S110]

- Medicinal cannabis [S86]

Comments and ideas:

  o The comments and ideas submitted to the GNZSP site related to things that affect people the most: e.g. diabetes, cancer [C91, C62, C148], how to prevent illness (good diets [C219], education, avoiding environmental pollution and food contamination [C246]).

  o People are concerned about what will be significant burdens on the country in future such as mental illness and ageing [C204, C188, C298].

- o Others focused on the basics – e.g. following proteins rather than genetics [I149], looking at the natural gut microbiome rather than genetically modifying it etc. [I132]. Also an idea was raised about a database of NZ health research and data for sharing [I25].

- o This topic was the most popular for most of the campaign, and 'creating cures' captured the imagination of the public as a desirable thing.

- o However, there was a contrary theme about disease having been the only way to keep the human population in check [C259], now we are too numerous and consuming too much; also that modern lifestyles create their own health risks (use of herbicides, fungicides etc. with food production; environmental pollution [C246], sedentary lifestyles; alcohol consumption [C139]; excessive meat consumption[C219,C223, C233, C237, C345]; with a general conclusion that we should implement what we know to prevent avoidable illness, and not waste funds on new cures.

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	792
Submissions	14
Comments	61
Youtube views	296
Facebook	
Comments	427
Likes on posts	508

Land and water

Land and water	The submissions under land and water were primarily about protecting waterways from agricultural nitrogen runoff. Some other opportunities were also submitted.
	• *Kei te hiahia mātau kia aro ake koutou ki ngā awa kia tiakina. Me pēhea tātau e tiaki te wai, arā te tātaru hoki i te wai? He aha te pānga ā ngā pāmu me ngā mahi poro rākau ki to tātau awa?* = We would like you to look at how we might better look after our rivers. How do we look after water, and more importantly ensure ongoing water quality? [C111]. What are the effects of farming and forestry on our rivers? [C78; C50]
	• Study the requirements of soil microbes to optimise pasture productivity and nitrate run-off reduction; includes riparian planting and associated root microbes. Replace chemical based fertilisers with biologically based fertilisers to reduce leaching of chemical toxins to waterways. "*The discontinuation of top-dressing onto pasture will reduce farm nutrient contamination of fresh water systems by 95%. Farm carbon emissions will be reduced by 15% to 20%.*" [C267]
	• Stop chemical fertilisers: Redevelop farming practices with rotation and biological fertilisation to promote bacteria and worm activity and reduce leaching of nitrogen to waterways [S63, S135]; use commercial soil microbial and mineral products [C303, C406]; promote organic foods and tourism [C37]; fertiliser from sewage/effluent [S127]
	• Educate farmers about value of microbial soil biodiversity [S75]; extension programmes for farm workers and owners – education about soil structure, fertiliser application and water quality [S88]

- Research to help clean up local streams [S1; C289]; develop a 'super sieve' to reduce harmful components from dairy run-off to our water [C207]; Research into eradication of rock snot didymo [M4; C38]; cleaner streams for cleaner coasts [C39; C64, C354]. Community water stewardship [C302] algae and microbes to clean water [S136]

- More data and mathematical modelling on a range of scales, to help understand what happens to fertiliser after application – to run off or leaching rates, how plants and soils retain fertiliser, and how much riparian planting is required to leave clean water. [C184]

- Joint water sources research, e.g. SMART project – mapping groundwater etc.[C319]

- Algae farms from dairy effluent to produce biomass for transport fuel (algae biocrude oil) [S89];

- Leaf protein (omega 3 fish oil replacement) concentrates from grass for export or aquaculture feed (potentially with fibre fraction used as biofuel for transport energy) [S124, C423]

- Research on economic transfer of external costs of environmental degradation to polluter (polluter-pays) [C320]; fund remediation; better economic return to lower environmental degradation (more dollars per cow, fewer cows per hectare) [C305]

- Minimise water waste: Self-sustaining housing -water collection, use and reuse [M216], Efficient and effective irrigation technologies [C132]; understand sewage treatment outcomes [C288]

- Increase productivity of orchards by harnessing more sunlight [C110]

- Surveying methods that don't destroy ecosystems [M198];

- Research on protecting bees -our key/only pollinators [C349; C276; S126]

- Genetic engineering for safe, sustainable super crops [M198]

- Utilise undeveloped Māori owned pasture lands; create labour-intensive high value uses; convert dairy cow in catchments to dairy goats in herd homes and reduce run off to waterways. [S43]; maximise land resource use sustainably supporting social and environmental values [M193]

In 2011, New Zealand had around 4.8 million dairy cows, up from around 2.7 million in the early 1990s.

Comments and ideas:

o Some comments supported science education programmes in schools/ communities (including on local waterways) [I8, I46]. Some supported organic farming to reduce pollution of waterways [I153, I76]. The latter comment(s) were refuted somewhat with the logic that organic production still requires as much water irrigation [I155].

o A theme emerged that we need to rethink our reliance on agricultural exports and better recognise the value we place on protecting waterways from fertiliser and effluent run off, and making farmers more accountable with higher environmental standards. Many comments pointed to the profit motive for degrading the land, only one pointed to the revenue gained from agricultural productivity (C79 quoted below). Sustainable agriculture is the country's backbone [C388]

o Find alternative high value, low pollution uses of land, e.g. adventure tourism [C387]

o Protect wetlands [C174, C359]

o Implement Clean Streams Accord [C240]; organic farming, riparian planting retire erosion-prone areas [C205], everyone adopt a stream [C214], make farmers more accountable / stop relying on agriculture [C209; C225; C230; C355; 358] re-think the whole economics [C266; C356; C301; C304]

- *New Zealand agriculture is already producing some of the lowest carbon footprint meat and milk in the world. Our farmers and scientists need to be supported by the public, especially when they bring in some 80% of our export earnings via product and industry related goods. … If we are to help feed the estimated doubled world population by 2050, organics simply will not get us there. What we need instead is clever, minimal impact use of the resources we have.* [C79]

- There is a general public concern over the use of chemicals in agriculture and food – due to their toxic effect on the environment and possible linkages with modern disease (infertility, neurodegenerative diseases). In addition, the notion of growing local food, organically, is better for health, the environment, and resilience to oil shocks than intensive monocultures. These concerns were reflected in discussion threads across many Challenge topic areas.

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	584
Submissions	11
Comments	48
Youtube views	237
Facebook	
Comments	753
Likes on posts	1,757

Resilience to natural hazards

Resilience to natural hazards	The public submissions on resilience reflected recent major hazard events.
	• Earthquake-proofing buildings – new materials / better designs; use of timber [S11]; better regulations [S6]; build stronger buildings [S106]
	• Improving resource transportation in times of disaster [S35]– roll-on-roll-off facilities at all ports; longer runways for freight planes; bridging equipment for fording rivers.
	• Raise the transparency of the 'nature of risk' at a national level, to identify mitigation strategies and argue reinsurance case more strongly with better risk management [M166]. Accelerate development of Riskscape modelling tools [M194]
	Comments and ideas:
	o True (holistic) costs of natural hazards and their likelihood to help decide on investments in avoidance/ mitigation /resilience. [C281]; invest in response methods rather than predictive research which has too many variables [C282]; or invest in both [C314]
	o Innovative timber engineering and construction techniques for strong and flexible housing [C212]; shorter buildings 3-4 storeys [C121]
	o Ocean-based tsunami warning devices [C200] and other methods of communicating warnings [C280]

o Education on risks of volcanos – Auckland is also at risk from natural hazards [C100, C198]

o Resilience to oil shocks – remove reliance on fossil fuels [C89]

o Social and psychological preparation and resiliency in addition to resilience of built environments, infrastructure, and business planning [C25]

Laser scanning earthquake damage to the Christchurch Basilica.

Photo: Margaret Low, GNS Science.

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	363
Submissions	2
Comments	22
Youtube views	217
Facebook	
Comments	240
Likes on posts	875

Our changing climate

Our changing climate	In general submissions and comments on climate change agreed it was our most pressing issue – the biggest issue of all, and requires urgent action and investment. • Social solution to mitigating climate change, rather than relying on new technology: implement low energy / waste lifestyles [S92, C51; C167; C309, C424]; educating people about climate change and getting them involved in the science [C362] • Pay the environmental cost at point of production, rather than point of clean up (e.g. taxes) [C6]; regulation rather than tax (economic) solutions [C308] • Low energy lifestyle – conserving fuel for future generations [S26]; being responsible for mitigating climate change because we won't be able to adapt if we don't make an effort now. Economic structures need to change – avoid dependency on consumerism and constant growth based on use of natural resources. • NZ as leader in climate change solutions [S18; M186; C226; C231] including population control; reduce greenhouse gas emissions, [C176]; export new technologies, mitigating impacts of climate change; fossil fuel replacement with renewable energy [S15, S58, C40, C389]; • Distributed electricity [S94]; efficient electricity production and use [S60]; local and personal electricity production – use water cycle as an energy option [S107]; • Magnetic generators, perpetual motor [S90]

- Geoengineering [C175] – stack water as ice in Antarctica to prevent sea level rise [S28];

- Alternative power systems [C112, C363] Liquid Fluoride Thorium Reactor [S91] Magnetic generators [C290, cross reference to 'zero emissions']; Wave power, Turning carbon dioxide (back) into fuel [S130]

- Research climate trends and impacts on localised weather; warning systems; consequences [S53, C113]; communicate well to the public [C93]; research impacts on biodiversity [C134]; research options for adaptation [C227]

- NZ's cultural heritage [S49] – baseline studies on coastal archaeological sites relating to Māori and early European settlement; and whether / how to save them from sea level rise and more extreme weather; excavate to recover information.

- Optimal forest types for carbon sinks [S66] potential for lichen farms (as carbon sinks) where other plants don't grow [M206]

- Biochar to sequester CO2 from plant waste; develop low-cost biochar kilns for distributed use [S93]; hemp industry to sequester CO2 – multiple applications [S95]

- Research technologies for low-emission open-source design and construct affordable carbon dioxide scrubbers to enable ubiquitous construction [S69]

- Research impact of industrial wind farms on atmospheric thermodynamic distribution [S96]

Comments and ideas:

- The comments and discussion threads supported action on climate change, including carbon sequestration (e.g. mangroves), alternative energy production, and even geoengineering in Antarctica. People promoted new forms of energy (including refuting some of the pseudoscience, and opposing the idea that we could 'escape' earth to another world). There was discussion that our energy consumption problems are a policy issue rather than science, e.g. we don't have a policy for distributed generators (e.g. households) selling electricity back to energy companies, as occurs in Australia and Germany.

- Our most important issue, and for our Pacific neighbours [C268].

	o The 'economy' needs to come second priority behind the environment [C175; C271]
	o Adaptations to farming e.g. growing kiwifruit in cooler latitudes; risks of sub-tropical insect pest incursion [C234, C190]
	o Stopping eating red meat would reduce impact on climate of growing it [C241]
	o Forefront of climate research to provide leading market advice to organisations involved in green technologies and climate solutions [C231]

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	579
Submissions	18
Comments	47
Youtube views	282
Facebook	
Comments	324
Likes on posts	791

Our rich seas

Our rich seas	Submissions on this challenge related mainly to fisheries research: • Study and protect the Ross Sea and Antarctic Territories [S70]; learn more about marine ecosystems so we can help protect them [C9]; research that supports sustainable fisheries [C41, C253]; work on international stock sustainability and protection especially Pacific Ocean[C11]; protect fish and marine life with marine reserves [S65, C42, C425]; research changes to fishing techniques [S44; C114 – whitebait]; restrict vessel tonnage [C273]; fish farming in the ocean [C326, C379]; put eels under a quota system [S34] • Study potential effects of climate change on fisheries, e.g. shells, nutrient mixing [C311, C338, C368] • Analyse risks from sea bed mining: [S59] e.g. whether toxins from land that are stabilised in sea bed sediments are stirred up by mining creating increased risks to food chain and reducing photosynthesis in water column [S23] • Marine energy generation [S129]; wind-wave electricity generation combined with marine reserves [S97; C8]; effects of marine turbines on fisheries [C80]; tide generation in Cook Strait [C325]; and solar [C411] • Minimise plastic entering oceans through catchment baskets for on-shore storm drains and pollution sites [M207; M216]

Oceanographer Dr Peter McComb studies waves and currents to improve understanding of marine resources.

Comments and ideas

- o The comments submitted to the GNZSP site supported conservation of species (e.g. eels, marine mammals - in particular Maui dolphins) and marine areas (e.g. Ross Sea, Akaroa), and altering or researching new fishing methods to be more sustainable and ethical (e.g. banning trawling / gill netting). [C114, C185, C41, C160, C196, C206, C215] There were a handful of references to prevent extinction of Hectors and Maui dolphins [S44, S59, C160, C364, C412, I171]. Many comments opposed mining oil (due to uncertainty of impacts, as well as future climate change impacts) [C368, C272, C273, C293, I26, S18, S23]

- o Study and implement solutions to coastal silting from upstream erosion [C337]

- o Marine protection and fisheries management needs a three-pronged strategic approach – 1) political will, 2) research scientists, and 3) public education [C229]

- o Stop fishing Ross Sea and keep our seat on Commission for the Conservation of Antarctic Marine Living Resources 'clean'. Reconsider how much of our own ecosystems we'll damage to feed global fish markets. Use science to end the tragedy of the commons. The Ross Sea should be made a World Reserve and left alone [C215].

	o Train Māori and Pacific scientists in these key areas [C410]
	o Don't deplete natural resources just for money now. We should protect the environment so it last for a thousand more years [C273]

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	572
Submissions	6
Comments	53
Youtube views	542
Facebook	
Comments	66
Likes on posts	415

Protecting New Zealand's biodiversity

Protecting New Zealand's biodiversity	The submissions are as follows
	• Biosystematics of NZ flora and fauna / phylogenetic relationships and evolution; distribution; traits; biodiversity research supports trade and international relationships [S51, M216]; harness museum collections to track biodiversity over time [S118]
	• Enhancing biodiversity in areas where NZers live, work and play – both an important and popular goal [S123] [S48]; native bird corridor [S131]; Bat protection; [S5] and research [S133] saving other native species [S30, S45, M12, M58]; sustaining native forests [M18];
	• Restore NZ's natural ecology/ecosystems [S119; M141] Research the current status, basic ecology and potential for recovery of the 600 most threatened species on the DoC list; introduced animal and plant pests and their control/eradication (especially possum biocontrol [S120]); plant competition from exotics/rejuvenation of habitats; community involvement – tech transfer to industry and community [S48].
	• Technology for pest control – e.g. self-re-setting trap; also creates biodiversity protection and employment [S45]; flying killer drones to identify and kill mammalian pests, weeding drones for plant control [S98]; removing mammalian pests (stoats) with sonic barriers – high pitched noise [S99]; pest control that is preferably non-toxic [C201], and control for the sea too
	• Green technologies especially energy to avoid biodiversity risks from oil extraction [S23]

- Carbon accounting for native / undisturbed habitats (excluding methane emissions from fauna) to determine if they are better carbon sinks than monoculture commercial forests. [S66]

- Research on Kauri die-back to inform protection choices (e.g. closing tracks / aerial spraying); Kauri was voted favourite plant in 2012 by the NZ Plant Conservation Network. [S52; M192, I180]

- Whole genome sequencing of endangered species and analysis of genetic diversity and disease susceptibility [S125]

In one night New Zealand's 35 million opossums can eat 12,000 tonnes of vegetation.

Comments and ideas:

- o There were a few clear themes that emerged from the biodiversity challenge comments. Most agree we need to protect our NZ native species from pests [C22, C43, C44, C45, C52, C67, C82, C87, C118, C119, C144, C179, C186 C216, C313, 371, 373, 392, C294, C400, C413, C414] (pests being weeds, predators and infections [C393]). One person said this should include lesser known species [C19], and another, microorganisms [C147]. Only one person said it's not worth it because we live in a naturally open system [C278]. People wanted new technologies for pest control [C242, C279] some non-toxic [C201], and some that involve sterilisation [C393, C394], particularly to replace 1080.

- o Several were opposed to 1080 [C20, C97, C117, C140 C254, C276 C277 C394] while one person supported it (who uses it in bird protection programmes) [C313].

	o	Community involvement was seen as important or sought everyone's contribution [C116, C295, C426,C427, C428]; including improving biodiversity outside the DoC estate e.g. farms [C86, C115].
	o	As well as controlling pests here in NZ many wanted to stop pests arriving e.g. through better border detection [C85, C162, C178, C294, C395].
	o	Some said we need to find out what we've got first [C141, C243, C331] in terms of biosystematics and understanding habitats and ecosystems [C53, C55, C87].

Website & Facebook snapshot

Websites – GNZSP & MSI	
Supporters	760
Submissions	14
Comments	72
Youtube views	156
Facebook	
Comments	265
Likes on posts	596

Other ideas

Background	There were 50 'other' submissions through the Great NZ Science Project website, plus additional comments on these ideas. There was an interesting thread on education suggesting evidence that should be applied to education (primary to tertiary).
	There were also discussion threads about: how best to use science evidence; a space programme in NZ (which some said we can't afford); and general comments about the site (including an argument about whether people's ideas were policy issues or science – James Renwick helpfully pointed out that many issues have scientific components).
	The general themes of the 'other' ideas submitted are grouped broadly below. Some of the 'other' submissions were re-classified to their appropriate Illustrative Challenges, e.g. research on bats (biodiversity).
Other-scientists and use of science	• Apply Established Scientific Knowledge To Improve Our Society. Expert groups should be used to identify problems, research solutions, promote solutions through the media and work with interest groups to apply solutions [S32]
	• Encourage lifelong, adaptable, scientific thinkers [S111]; Use scientific method to inform public policy [S57]
	• Scientists and research institutions should publicise findings in an interesting way, so public can hear about it [S8]; science superstars on TV [S114]; better inform the public on virtues and limitations of science [I35]
	• Retain and build up scientific skills; make science more efficient by increasing success rate of funding proposals [S101]
	• Research institutions to better support commercialisation of science: co-employ academics (secondments) to support business R&D / support start-ups [S102]
	• Mātauranga Māori and Te Reo – protect the latter to transmit oral historical knowledge [S17]
	• International collaboration, especially with Asia - business partnerships rather than competing [S20]

	• Apply scientific effort at areas of maximal benefit to New Zealand (not duplicating overseas strengths; solutions-focused rather than baseline measurements) [S108] • Support fundamental data collection that may have unknown future applications to underpin long term outcomes [M174] • Remember that in a reductionist paradigm (analysing parts of a whole) we mustn't forget how to put the parts back together, and work at a systems-level. [I186]
Other - education	• Apply the scientific method to the education system; select improvements to education based on scientific method [S14]; use science in communities to help New Zealanders get answers to their own problems, learn to appreciate science, and contribute to the massing and analysis of data (e.g. bioblitz) [S105]. • Use science to inform quality assurance assessments for the education system – standardised testing and high stakes exams is not the answer. Teachers know how children learn; it's the exam system that stymies science skills and creativity. [S14] • Research new ways to improve science learning [S8] e.g. science books for children [S116]; after school science programme, taught by people working in science / engineering / manufacturing industries - practical skills such as design, analysis, calculation, electronics, software, materials, and creativity in solving real engineering problems; e.g. teardowns and technology applications [S19, M51, M52; M103, M216]; [I8 to 16] • Scientists translate complicated science ideas to suitable material for education (at all levels) and train teachers [S8]; need a vision for science teaching and time for up skilling [C370] • Break cycle of underachievement, unemployment and crime among school leavers from lower socio-economic backgrounds [M159] • Science education to improve evidence-based decision-making [M150]
Other – energy	• Energy is the 21st century space race – New Zealand should select a promising set of low emission, low cost, (local?) ideas for development and, potentially, export [I182].

	• Efficient, environmentally safe energy production [M81]; marine energy generation [S129]; carbon sequestration and alternative uses of coal [S115]
	• Research the most cost-effective way to make household electricity needs onsite [M219]; goal is to become less reliant on oil and have more electricity available. [S60; M31]; 100% renewable electricity [M59]; energy security [M151]
	• Electric tracks to transport electric cars on main corridors at high speed but low cost; "zero emission transport" [S7, I37, I47]
	• More cycle and walkways both in cities and rural areas [S3] research on healthy transport [M216]
	• Biodegradable plastic [S38]
	• Liquid Fluoride Thorium Reactor [S100]
	• Wireless energy transmission long distance (energy beam from space) [S104]
	• Internal subatomic expansion engine [M212]
Other - space	• Develop a space programme in NZ [S29, S62, S112] - develop light craft capable of placing a payload into Low Earth Orbit; support Square Kilometre Array; increase space research through night sky reserve at Tekapo; support other astronomical sites [S61].
	• Astronomy [duplicated: M100, 102]
	• *"If we built spaceships, we could go live somewhere else because we broke the climate."* [S2]
Other - IT	• Large Software Projects – use scientific method to ensure efficient productivity [S54]
	• Develop technologies for holographic communications (multiple applications) [S103]
Other - economy	• Bioprospecting NZ's unique flora and fauna [S121]

	• Viticulture and wine research to maintain premium in world wine market [S12]
	• Increased productivity in environmentally sustainable way (agriculture sector) [M171; M172]
	• Pseudo-alcoholic drinks - drug replacement for alcohol and alcohol removal mechanism for drinks that retain flavour – grand goal is to replace alcohol with a benign substitute. Big export potential, and savings in alcohol-related public costs [S55].
	• Science as a co-driver for NZ's environmental economy: value underpinning knowledge; feedback loop between knowledge, regulation, exploitation and science. Use of science to develop a shared view of sustainability. [S36]; measure ecosystem services to ensure we can continue to rely on them (what gets measured gets done) [M225]
	• Set up a derivatives market for rates and index instruments; as a global signalling market for APAC markets [S74].
	• Machines that make machines; automate production of machines to produce basic goods and services (food, energy, clean water). Goal of challenge is abundance for all [S76].
Other - society	• Law – applications for environment and reducing incarceration. [S33]; developing and evaluating criminal rehabilitation systems [S132]
	• Self-sufficiency [M13]; replicate Venus project – green town [M64]; behaviours that control pollution (awareness and community programmes) [M215]; indigenous biodiversity into cities [I178]
	• Extend useful lifespan of humans [M35]
	• Develop a NZ Gross Happiness Index to drive decision making [M42]; measures of wellbeing and inclusive governance processes [M173]; research and educate about what is required to make people happy/satisfied and empowered [S113]; study shared values to inform complex decisions involving collaborative networks and governance tools [S138]; what is a sustainable society? How do we manage resources sustainably? [S128]
	• Create global companies owned in NZ like Fonterra [M106].

	• True Battlefront History – archaeology of NZ Māori wars to develop and recreate historical sites [S137]
Other - blue skies science	• *"Our national goal should go beyond quality of life in Godzone over the next 10-20 years"*. Our scientific international collaborations should contribute to the growth of knowledge for its own sake – expand scientific frontiers by forming relationships with science systems in other countries [S71] • Archaeology to understand how historic people solved past challenges [M132] • Geographical mathematics [S122]
Other - demographics	• Develop day-to-day technology for an aging population (rather than technologies that marginalise them). Includes design of homes and buildings, communication, transport (around homes and cities), entertainment, community whanau and knowledge connections. Which technologies can encourage and contribute to people leading healthy, active lifestyles throughout their lives? [S64]
Other videogames & creative industry	• Listen to our children and value videogames – educational, psychological, cultural aspects; on-line behaviour, haptic technologies, social networking, other creative industries [S109]

Website snapshot

GNZSP and MSI site supporters, Youtube views and Facebook statistics – not applicable

Website – GNZSP	
Submissions	50
Comments	50

Reflection on Facebook

The Great New Zealand Science Project had a Facebook page, on which 'story arcs' (questions and statements) were posted to trigger discussions. These were aimed at a cross section of our society's demographics, and each one stimulated discussion from a variety of respondents.

The discussion was wide ranging and engaged a large number of people. While there were lobby groups and misinformation both promulgated through the Facebook site, most discussion was by individuals from a cross section of society, with input at times from science experts in particular areas.

People are generally concerned with the science that affects them, as individuals. This included concerns that we have to mitigate climate change, concerns about chemicals on and in food, educating people how to live healthier lives to reduce preventable illnesses. This is consistent with previous research on public understanding of science.

People hope that science can deal with uncertainty, e.g. risks to the environment due to human activities; from deep-sea mining to intensive agriculture and the built environment. There are common threads. People want us to lower our impact on the environment, but also want living to be affordable; e.g. organic produce that's not too expensive for everyone to afford.

Because there was a large, disparate set of discussion threads that did not reveal significantly different concerns from the general tenor of the GNZSP site, the Facebook and Twitter threads were not systematically analysed to include in this summary.

Media campaign and market research

The Great New Zealand Science Project media campaign was designed both to elicit submissions from the public and to raise awareness of the value of science and innovation for the benefit of New Zealand. The media was evaluated using standard techniques. The Mid-Campaign Research Debrief report will be available to interested Peak Panel members at their meetings.
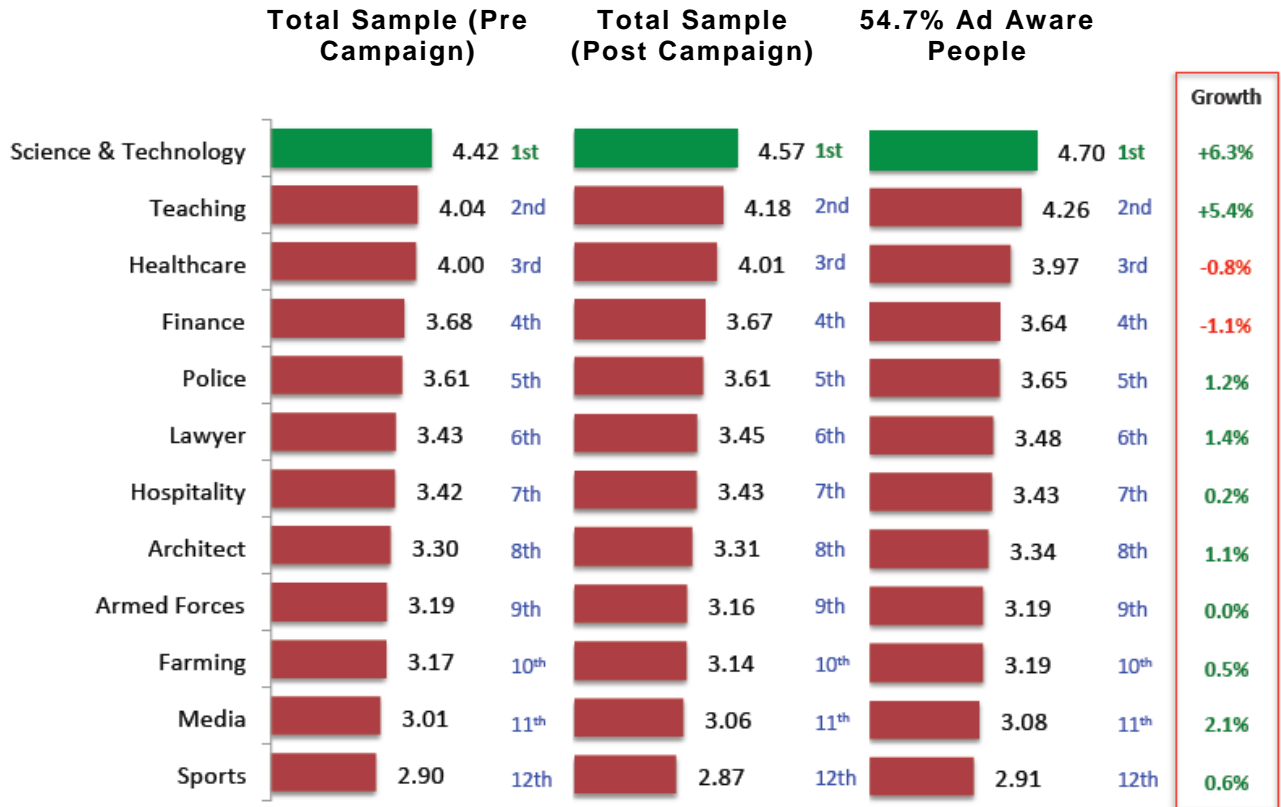
The results from the mid-campaign study showed a strong GNZSP media campaign performance in terms of achieving the goals. Awareness measures of the campaign were higher than might have been expected. The impact on the perception of the role of science and technology in creating a prosperous future for New Zealand was positive and substantial – as was the impact on career consideration for science and technology and teaching.

Over half (54.7%) of people surveyed were spontaneously aware of the campaign, remembering it when prompted by name only. All advertising diagnostics showed a positive impact of the campaign content, both for those who had seen the campaign (the 'Real World' test), and for those exposed to the campaign for the first time during the research interview itself (the 'Lab' test).

An example of the research follows:

Q: If you are/were young and just setting out on your career now, how much would you consider each of the following careers?

(*1 = "wouldn't consider at all" to 7 = 'Would consider very highly"*)

	Total Sample (Pre Campaign)		Total Sample (Post Campaign)		54.7% Ad Aware People		Growth
Science & Technology	4.42	1st	4.57	1st	4.70	1st	+6.3%
Teaching	4.04	2nd	4.18	2nd	4.26	2nd	+5.4%
Healthcare	4.00	3rd	4.01	3rd	3.97	3rd	-0.8%
Finance	3.68	4th	3.67	4th	3.64	4th	-1.1%
Police	3.61	5th	3.61	5th	3.65	5th	1.2%
Lawyer	3.43	6th	3.45	6th	3.48	6th	1.4%
Hospitality	3.42	7th	3.43	7th	3.43	7th	0.2%
Architect	3.30	8th	3.31	8th	3.34	8th	1.1%
Armed Forces	3.19	9th	3.16	9th	3.19	9th	0.0%
Farming	3.17	10th	3.14	10th	3.19	10th	0.5%
Media	3.01	11th	3.06	11th	3.08	11th	2.1%
Sports	2.90	12th	2.87	12th	2.91	12th	0.6%

'Snapshot' Facts

Careers in 'Science & Technology' started at #1 in the priority list before the campaign, and consolidated this lead with a move that represents 6.3% growth in its Mean Consideration Score.

Notably, 'Teaching' has also seemed to benefit from the campaign.

[*N.B. Figures are the arithmetic 'means' – the average of all respondents' ratings*.]