

A business lens on STEM

**Exploring Auckland business investment in the
science, technology, engineering and maths
skills pipeline**
a scoping document

COMET Auckland

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July 2014



Whakatauki

E kore e taea e te whenu kotahi
ki te raranga i te whāriki
kia mōhio tātou kiā tātou.
Mā te mahi tahi o ngā whenu,
mā te mahi tahi o ngā kairaranga,
ka oti tēnei whāriki.
I te otinga
me titiro tātou ki ngā mea pai ka puta mai.
Ā tana wā,
me titiro hoki
ki ngā raranga i makere
nā te mea, he kōrero ano kei reira.

*The tapestry of understanding
cannot be woven
by one strand alone.
Only by the working together of strands
and the working together of weavers
will such a tapestry be completed.
With its completion
let us look at the good that comes from it
and, in time
we should also look
at those stitches which have been dropped,
because they also have a message.*

Kūkupa Tirikatene

About COMET Auckland

COMET Auckland, Te Hononga Akoranga (Community Education Trust Auckland) is a charitable trust and Council Controlled Organisation (CCO) of Auckland Council. Our mission is to advance education for Auckland.

About this report

COMET Auckland undertook this study at the request of the Auckland STEM Alliance, a business-led coalition working to increase the STEM skills pipeline.

Our thanks go to the people we interviewed and those who reviewed a draft of this document. We acknowledge the generosity of O-I NZ, Dean Carruthers of Jasmex, The Skills Organisation, NZ Institute of Food Science and Technology and NIWA for allowing us to use their photographs.

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Download the report from COMET Auckland's website www.cometauckland.org.nz

Report No 075/14



Key messages

The Auckland STEM Alliance wants to drive innovation-led economic growth and grow a workforce skilled in science, technology, engineering and maths (STEM) to meet industry needs.

Some companies invest strategically in STEM education where it fits core business. A small number of companies invest in the STEM skills pipeline in multiple ways, primarily through scholarships, internships, graduate programmes or sponsor competitions and events. The most focused investment is with tertiary students and senior secondary students.

Some companies invest in a more restricted way, sponsoring a scholarship or providing a graduate programme.

Many businesses that are STEM related do not appear to invest in STEM skills building. They are more likely to sponsor community environmental or child wellbeing projects and do so out of corporate social responsibility. Writing a cheque to sponsor an event is easy.

Environmental action and child wellbeing projects have the potential to trigger a longer-term interest in STEM, if there are strong connections between the project and the curriculum and teachers actively support students to see the clear pipeline to STEM subjects and jobs.

Businesses are unlikely to deal with schools directly. They are more likely to support intermediary organisations (often industry-led) to organise scholarships, competitions and events and manage the relationships with education, because it reduces the demands on the company. These intermediary organisations are an important part of the STEM education landscape.

Most companies don't have the capacity to go and look for ideas about how to invest in the STEM pipeline. They need to have effective approaches brought to them. There are opportunities to learn from and connect to collaborative STEM education initiatives overseas.

There are opportunities to grow investment in the STEM education pipeline



Executive summary

Science, technology, engineering, and mathematics (STEM) subjects are increasingly important to our economic competitiveness because of the vital role they play in developing new technologies, high value products and innovation in our economy.

An Auckland STEM Alliance of businesses and other organisations wants to increase investment in STEM skills, to ensure Auckland has an appropriately skilled workforce.

To understand the extent to which businesses were supporting the STEM education pipeline, we reviewed 270 programmes from 140 Auckland companies and interviewed thirty key informants.

Businesses that were investing in STEM looked for approaches that were focused, clear and understood their business imperatives. A variety of approaches were used.

- Targeted tertiary scholarships, the most frequently mentioned approach; some of these scholarships start during the transition from senior high school
- Providing structured work experience, apprenticeships and internships that help young people get work ready while providing a pool of potential talent for companies
- Supporting competitions and events to grow passion and enthusiasm; this can be at a national scale or at the level of an individual project in a single tertiary institution
- Enabling staff to run sessions in schools to inspire a passion for science and to advocate for employment opportunities in STEM industries
- Lecturing in industry-related tertiary programmes
- Mentoring tertiary students to complete practicums and industry related assessments
- Providing contestable funds for school projects, usually related to the environment; this could be a national fund or around a local business operation.
- Allowing onsite visits from school and tertiary students (not common because of health and safety issues at the business end and transport and organisational difficulties at the school end).

Those companies that did invest in STEM education did so with varying degrees of intensity. A few large companies invested systematically and extensively because of the clear fit with their core business and their requirement for a significant STEM-skilled workforce. These companies offered apprenticeships in qualifications relevant to the business, funded tertiary education scholarships, provided paid

**At least 45
Auckland
companies
investing in
the STEM skills
pipeline to
varying
degrees**

There is potential to grow investment and to better leverage off what is currently invested

internships to give students practical experience and funded competitions and events.

A more modest investment might involve providing a scholarship for a tertiary student with scholarships, work placement and internship.

Smaller organisations made a much smaller investment, typically contributing a few hours of a staff member's time to school visits to promote jobs in STEM industries. Modest investment also could include a prize for successful completion of a tertiary assignment, providing work experience opportunities for 5 days a year; making the board room available and a staff member's time for a group of students to complete a real-world focused tertiary assignment.

Many companies, even those in STEM industries, had not thought about investing in STEM education. Most were funding environmental or child-wellbeing projects, primarily out of corporate social responsibility.

Intermediary organisations interface with schools in a number of ways. Typically industry-driven or owned, they organise programmes to bring STEM-focused speakers to schools and run industry-driven competitions and events. Their organising structures reduce the load on businesses and the requirement to have relationships with individual schools. The intermediary organisations are often national and competing for funds. It will be important to link them into any regional network.

Many environmental and child wellbeing projects sponsored by business had the potential to inspire an interest in STEM subjects but the extent to which that happens depends on the aspirations and expectations of schools.

It is difficult to establish the dollar value of the STEM investment in Auckland and the impact of it, because of the complexity of multiple sponsors of a project, national projects accessed locally and global online initiatives sponsored by multi-nationals being accessed by local educators and local students.

Collaborations around STEM education (particularly around science and maths) are developing rapidly overseas, with major business investment, providing some useful models for the Auckland STEM Alliance to consider. There may also be opportunities to expand STEM projects currently being offered only in Australia by companies with a presence in Auckland.

Background to the report

Science, technology, engineering, and mathematics (STEM) subjects are increasingly important to our economic competitiveness because of the vital role they play in developing new technologies, high value products and innovation in our economy. STEM will play a critical role as we face the challenges of environmental issues and sustainability and surviving in a rapidly changing global economy.

There is a labour market shortage in STEM related industries and our future workforce needs to be more skilled. We also need an increasing degree of science literacy as citizens, to make informed decisions about the challenges our society faces. Concern has been expressed for some time by the Royal Society and the Chief Scientist about the lack of STEM skills, both in the workforce and the population generally. There is also concern about the place of science in the school curriculum. Science is not compulsory at Year 11 and students only need to achieve a basic level of numeracy and mathematics to achieve NCEA L2.

The Auckland STEM Alliance is an emerging network of businesses, Crown Research Institutes (CRI) science interpreters and education groups advocating for infusing a higher level of STEM skills into education (both in school and wider community settings). The Alliance wanted to know the extent to which Auckland businesses are investing in building science, technology, engineering and maths skills in the future workforce by linking to education:

- Who is investing in science and technology education within schools and or within the community?
- What is the scale of support that is being provided?
- What are the gaps and opportunities across Auckland?

Scope of this report

This report scopes some of the action and issues about STEM education in Auckland, to help start discussions. Our focus has been on business investment in STEM, rather than the STEM landscape as a whole. Many more organisations are in the STEM education sphere of interest than are represented here.

The report is also presenting very general information from a small number of companies. Categorising activity as Auckland only was not always possible. A national company may invest in a national project, accessed by our local schools and some local providers may be accessing global online initiatives in the IT sector that are not mentioned here.

The skills pipeline is vulnerable when young people drop science early

The approach

First, contact was made with members of the STEM Alliance. They referred us to companies that they thought had an interest in STEM or projects they knew about.

Companies referred us to initiatives supported by business-linked philanthropy such as ASB Community Trust, Coca Cola Foundation, McDonalds/Ronald McDonald House, Telecom Foundation, Vodafone Foundation. Several projects were linked to health trusts related to our District Health Boards.

Those contacts and interviews, plus web searches of companies, identified a number of intermediary organisations involved in STEM related activity. These intermediary organisations included education and community NGOs as well as business associations.

We scanned approximately 270 projects from approximately 140 organisations and had short phone interviews with people from 30 different organisations.

In some companies it took time (and several phone calls and emails) to identify a company representative who knew about the STEM work. Those interviewed were in HR, Communications, Training, Community Relations or Sustainability (and sometimes based in Australia). Some companies that we anticipated having an interest in STEM chose not to be interviewed.

We took a broad view of what was STEM education right through this project, to help us understand the landscape. If a website said a programme was intended to link to the maths and science curriculum in schools, it was considered.

Education and community NGO, science intermediaries, professional associations and local business associations and government departments were excluded, because of the Alliance's particular interest in business investment.

This report does not include any data on the uptake in Auckland of the many online learning initiatives from global IT companies (IBM, HP, Microsoft, Datacom and Cisco). Further research would be needed to find out the impact they have on the STEM landscape in Auckland.



The Findings

1. Who is investing in STEM education?

Of the 140 companies contacted, 45 were investing in some kind of STEM education initiatives (Figure 1). Almost all were stem-related businesses or business-led philanthropy. Most of these companies were most likely to sponsor industry-related projects.

Many other companies in the sample were sponsoring community projects, usually related to the environment or child wellbeing. This investment was most often not related to STEM, nor necessarily related to a company's core business.

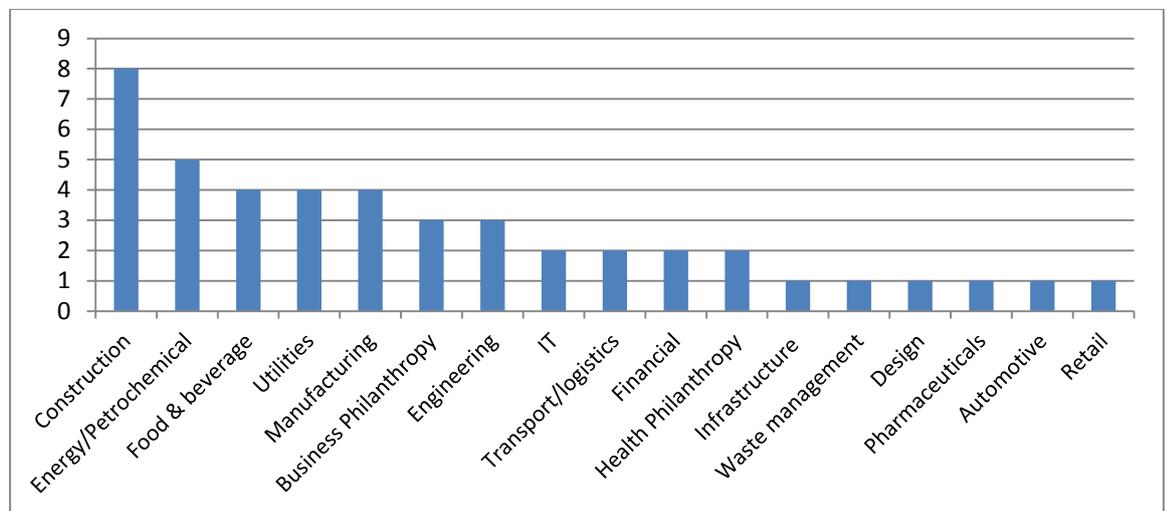


Figure 1 Types of companies investing in STEM education

2. What is being invested in?

Figure 2 below shows the ways the businesses in this study were investing in STEM education. There were three different levels of STEM investment: larger companies investing in quite a few strategies; medium size companies doing several things; smaller organisations supporting one initiative. Scholarships were the most common type of business investment.

Some STEM-related businesses are supporting community projects rather than a STEM pipeline

Some investment is industry – specific but not all

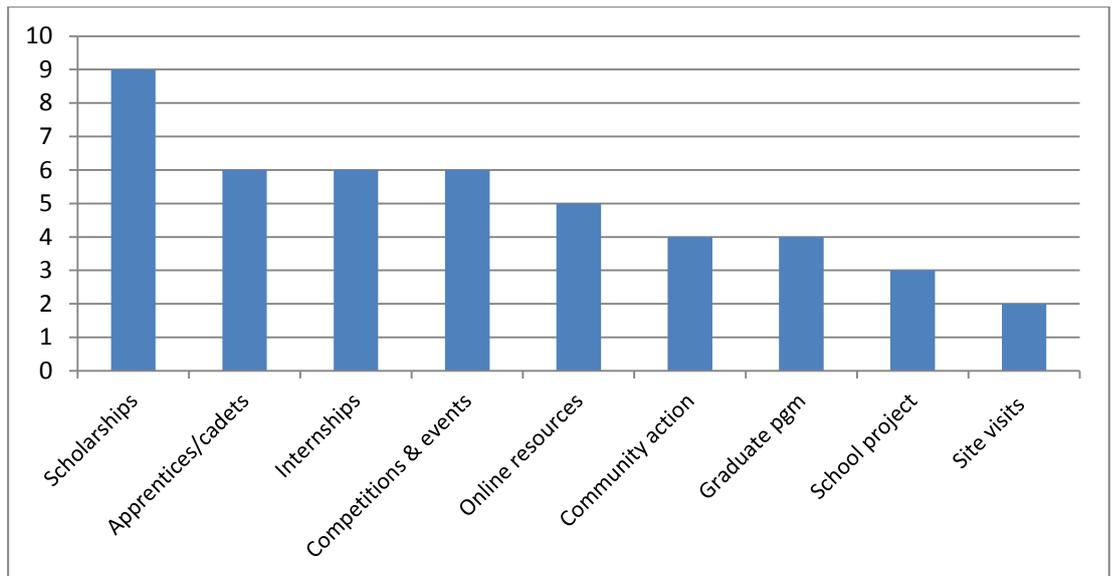


Figure 2 Ways businesses invest in STEM

Multi-strand STEM investment

A few larger companies were investing heavily in STEM education across a number of parts of their business because they saw the need for a skilled workforce.

Tip Top (part of the Fonterra Group)

- offers 3 month internships for food science or technology tertiary students over summer
- supports young staff to be Futureintech ambassadors, to go into schools to talk about the importance of studying math and science and the opportunities that they open.
- enables staff to mentor high school teams for the NZIFST/CREST PD challenge
- staff give lectures to food science and technology students about ice cream and flavour matching.
- offers site visits to local schools to see how the product is made.

Downer New Zealand Ltd is typical of larger companies, investing in the STEM pipeline from the end of secondary school:

- a cadet program for earning while completing the National Diploma in Civil Engineering. Fees, textbooks, stationery and any travel and accommodation costs are covered. Cadets have access to a mentor and support from peers and managers and six-monthly performance appraisals.
- internships and university scholarships
- professional development support so employees can gain additional qualifications.

More STEM focused tertiary scholarships would grow the pipeline of graduates, particularly if linked with work experience

Scholarships

Providing scholarships, particularly for engineering, was the most common way businesses invested in STEM education. Typically, companies contributed to tertiary undergraduate scholarships. For example, Fisher & Paykel sponsor four Maurice Paykel undergraduate scholarships in engineering nationally each year. Successful students get a cash award of \$2,500 and paid summer employment for up to 12 weeks. Hubbards offer scholarships for food technology undergraduates (albeit at Massey University, Palmerston North) and holiday work experience.

A few businesses supported high end STEM education that was a mixture of scholarships and supporting qualifications. Examples included:

- Mighty River Power's sponsorship of the University Of Auckland's Chair In Geothermal Reservoir Engineering
- L'Oreal Paris NZ's Women in Science fellowships
- Fletcher Construction's scholarships for post-graduate students of Engineering.

Most scholarships were organised through a tertiary provider or an intermediary organisation such as First Foundation. For example, Fletcher Building contributes 10 scholarships to First Foundation each year. The scholarships commence before the start of Year 13 and continue for four years. Each full scholarship costs \$22,000 over its 4 year duration and scholarship sponsors provide a minimum of 5 weeks paid work experience annually. Students are mentored and also participate in an Annual Scholarship Review with their sponsor.

The First Foundation gave out 6 science-focused scholarships last year and regularly gives out several to engineering students each year. Approximately 30 Auckland schools nominate young people (from families with modest to low incomes) and the Foundation has more applicants than it has scholarships to offer. Scholarship partner organisations are able to specify the qualifications pathway (engineering, science, health etc.) they wish to support and the Foundation finds appropriate students. First Foundation sees potential for more STEM scholarships.

<http://www.firstfoundation.co.nz/first-foundation/our-story.aspx>



Apprenticeships, cadetships and internships

Providing an 'earn and learn' opportunity through apprenticeships and cadetships was quite a straightforward way of building a STEM workforce, particularly for larger companies.

Many companies are on the lookout for talent to bring into intern and graduate programmes. Jasmax talked about looking for good potential graduates when staff taught on industry-specific tertiary programmes. Auckland Council is sponsoring environmental student partnerships for senior tertiary students, offering work experience and support for applied research.

Competitions and events

Competitions are a significant part of the STEM education landscape. The examples below are not a complete list.

Fisher & Paykel Healthcare is a major sponsor of *Kiwibots* and the *Vex Robotics Competition*. The Competition aims to inspire a passion for science and technology by having teams develop, over a period of time, the robots to the best of their ability and then have those robots tested on a 'field of dreams'. The *KiwiChallenge* is an initiative started in 2012 that allows new teams and schools to become introduced and involved in the VEX Robotics Competition without having to dive into the deep end of the full worldwide VEX competition. <http://www.kiwibots.co.nz/>

Fonterra is a major sponsor of the *NIWA Auckland Science & Technology Fair*. The Fair held annually, celebrates excellence in scientific and technological investigation carried out by local Year 7 to Year 13 students. Twenty six cash prizes are awarded (a \$150 for silver plus 5 \$750 prizes). <http://scifair.org.nz/index.html>



Orion Health, Fonterra and Fisher & Paykel Healthcare sponsor the annual *New Zealand's Next Top Engineering Scientist*, a problem solving 1 day competition for secondary students focused on maths and science. The top prize is \$6000.

<http://www.des.auckland.ac.nz/en/for/secondarystudentsandschools/nzntescompetition.html>

Smaller scale investment in competitions is possible. As an example, a collaborative effort between the University of Auckland Engineering Library, the Faculty of Engineering and Fletcher Construction challenged Engineering students to see what they could make with a set number of plastic Zone sticks and balls and collaborative brain power in a limited time, using their engineering design skills. Entry was limited to 20 teams and sponsored by Fletcher Construction with \$2000 in cash prizes.

Are current competitions and events attracting non-traditional STEM students?

Online STEM education resources are increasingly common.

Technology and online resources

Projects related to on line learning and global IT programmes were common in the global IT companies identified in this project.

An example of an intensive IT focused project is The *High Tech Youth Network*. The Network intends to empower young people and communities to become more capable, creative, and confident lifelong learners and to link cultural knowledge and technology skills. The intention is to build strong relationships within the local ICT community. Hewlett Packard and Microsoft are sponsors. <http://hightechyouth.org/>

Some companies resource environment-related teaching and learning materials on line that can be accessed by Auckland schools.

- Mobil is a major sponsor of the *New Zealand Marine Studies Centre* at the University of Otago. The Centre produces free, printable, online resources for schools about marine life.
- Air NZ Environment Trust support Department of Conservation to provide field trip-related resources for teachers online.
- Auckland Council funds school curriculum-related learning resources for students doing field trips in regional parks
<http://www.aucklandcouncil.govt.nz/EN/environmentwaste/sustainabilityconservation/environmentalprogrammes/learningthroughexperience/Pages/summaryofprogrammes.aspx>
- *Hector's World* and *ThinkUKnow* are projects to grow internet safety
http://www.netsafe.org.nz/keeping_safe.php?pageID=206§ionID=education

Environment education and action

Among this sample of companies, more were supporting environmental projects than any other type of programme. A couple were clearly STEM education:

- O-I NZ provide a \$25,000 Environmental Fund nationally for schools to develop sustainability projects that will develop students' skills in identifying, investigating and finding solutions to environmental issues, as well as getting local gains for the community around those schools.
<http://www.recycleglass.co.nz/case-studies/>
- The Bayer Primary School Science Fund is administered by the Royal Society of New Zealand. Schools apply for funding to teach and enhance both environmental science and 'nature of science' activities. Examples of projects include: Gardening equipment; Stream Health Monitoring Kits; Native trees and plants; Microscopes; Weather station kits; Books to support an existing teaching programme.

Other environmental projects are discussed below in the section on potential projects.

Linking directly to schools and tertiaries

Only two companies referred to a direct relationship with a primary school.

- Randwick Primary School, (near Mobil's Seaview Terminal) used Mobil funds to buy teaching resources including science kits and a life size skeleton. Mobil funding has helped schools close to other Mobil operations elsewhere to buy multimedia and computer equipment, science and maths books and a special science trolley for classroom activities.
- Pacific Steel helps a local primary school with a gardening initiative in Mangere, which may (or may not) have STEM outcomes.

Companies could support high level secondary or tertiary level STEM activities by providing speakers or guest lecturers, participating in career events, or by providing scholarships to school directly. These connections were not obvious from this group of companies.

Businesses tended to have only arms-length connections with schools, instead working with intermediary organisations that organised industry-specific school programmes.

Giving students work experience is a low-cost option for some companies. Jasmox provides short work experience sessions on personal request to school students interested in design and/or sustainability. The sessions are short – half a day to two days and ad hoc. On occasion Jasmox also host school classes – usually from new schools or major campus redevelopment. There is potential for young people to be involved in project design, but the company have found it quite hard to get agreement from schools for this to happen.

We recognize the essential role that proficiency in maths and science plays in the energy business and in facilitating human progress more generally. Mobil has proactively provided support to local schools in areas where we operate to promote science and maths education.

Mobil Oil

There were only two instances when companies referred to connecting with tertiary programmes. The first was the engineering assessment competition mentioned above. The second was related to final year tertiary students completing a practical assignment. Twice yearly, Jasmox offer an opportunity to a group of students who require workplace experience to complete the industry placement requirements for their course. The students attend together, get an orientation session on sustainability and collectively work on their own project onsite in a meeting room,

Few businesses have direct links with schools; some may link to tertiaries

with mentoring from Jasmox staff. This group approach is a more efficient and effective way of delivering work experience from the company's point of view.

A few companies in our sample were sponsoring education projects: supporting a local literacy programme; helping resource a local school's Reading Recovery programme; sponsoring Laptops for Learning or Computers in Homes or contributing to Manaiaakalani, a major initiative in Tamaki to promote 21st century learning through a multi-school network of enhanced digital learning.

3. Potential STEM education

Environmental programmes sponsored by many companies were loosely connected to the STEM pipeline (because they involve students, field trips, curriculum based courses and/or environmental action). Examples include:

- Fonterra's *Living Water* campaign is a collaboration between the Department of Conservation and local communities to enhance five major local waterways – the Kaipara Harbour near Auckland
<http://www.fonterralivingwater.com/index.html#Fonterra-And-Department-Of-Conservation?Kaipara-Harbour>
- Sanford Industries is supporting *Sustainable Communities*, a national community initiative to increase understanding of the marine environment and find local solutions. <http://sustainablecoastlines.org/education/education-overview/>
- *Enviro-Challenge* is an innovative programme to grow young people's leadership in sustainability. <https://www.facebook.com/EnviroChallenge/timeline>
- Meridian Energy has previously funded *Living Legend* Tree planting at Motihue Island <http://www.livinglegends.co.nz/>
- *Healthy Eating and Gardening*, a GardenHealth project related to diabetes and Enviro-Challenge

Investing in community projects related to the health and wellbeing of children and young people was also common in the companies we looked at, particularly programmes linked to the health education curriculum. There may be potential to link them to a city wide strategy in the future. Examples include:

- The *Garden to Table* project in many schools, that aims to promote healthy eating, an interest in gardening and an understanding of ecology
<http://www.gardentotable.org.nz/getting-results>
- The *Food For Thought* nutrition programme that aligns to the Health and Physical Education curriculum. <http://foodforthought.co.nz/>

- Sponsorship of the *Life Education Trust* that provides drug education (related to the health science curriculum). <http://www.lifeeducation.org.nz/>

There are likely to be projects that are not directly STEM related but where a STEM focus could be included – for example Fuji Xerox New Zealand’s *Next Generation Leaders Programme* to develop high potential secondary school students.

4. Intermediary organisations

Much of the STEM education investment comes by way of intermediary organisations who took career information about STEM specific programmes into schools. Typically, intermediary organisations identify young staff with STEM related jobs, who then go into schools for short sessions to speak about their work, aiming to spark an interest from students. Alternatively, some staff may mentor secondary students who are entering competitions. These programmes are industry specific and IT initiatives were the most frequently mentioned.

Food for Thought is a free nutrition education programme sponsored by Pams (Foodstuffs Ltd) to help Year 5 and 6 primary school students (9 -10 year olds) make healthier food and lifestyle choices. It is a community based initiative, designed and developed by nutritionists and teachers working in with the New Zealand

- *Bright Sparks*: Entirely funded by the Skills Organisation, an industry training organisation. Bright Sparks, now in its 14th year, was created to nurture and grow young peoples’ interest and skills in electronics and technology.
 - Students participate in a national online forum (and earn points for contributing to the discussion which they can trade for discounts on electronics components).
 - The annual Bright Sparks Competition sees school students develop a prototype using electronics, electrical engineering or programming elements over the course of a year, judged by a panel of industry experts.
 - Bright Sparks representatives operate nationally and actively support schools to offer programmes that include electronics and programming, encouraging project based teaching. Students can gain NCEA and also a specialist Certificate as part of this (the National Certificate in Electronics Technology - NCET). NCET is currently taught in over 200 schools around the country at Years 11, 12 and 13.
 - Companies can get involved by mentoring young people through



the online Forum, or by inviting The Skills Organisation to organise site visits to showcase how their business applies electronics and technology. <http://www.brightsparks.org.nz>

- *Futureintech*: Run by the Institute of Professional Engineers (IPENZ) and funded by Callaghan Innovation. Futureintech brings young technology and science graduates (degrees and diplomas) working in STEM roles into schools to speak as 'Tech ambassadors.' The average time investment per Ambassador is 7-10 hours per year. Futureintech also produces resources about STEM roles for schools, teachers and parents. 139 companies from North, Central and South Auckland are listed as supporters on the Futureintech website <http://www.Futureintech.org.nz/> IPENZ also provide tertiary scholarships and awards.
- *ICT-Connect*: An industry-led programme for putting young IT professionals into schools to inspire and educate young people about the options available in IT. The Auckland region is focused on for a term each year. <http://www.ictconnect.org.nz/>
- *Ultimit*: A project to increase the number of women in the electricity supply industry, of which Electrix is a major sponsor. Successful women employees and female trainees visit schools and talk about the opportunities of a STEM career in the new schools project. <http://ultimit.co.nz/>
- *Summer of Tech*: an industry sponsored Wellington based initiative that piloted an Auckland programme at the start of 2014. Industry funded, the project has three components:
 - Students are prepared for employment through free bootcamps, designed and delivered by local IT industry specialists.
 - The project holds Meet and Greets between industry and prospective interns
 - Companies offer summer internship with a guaranteed wage and a company mentor. <http://www.summeroftech.co.nz/>

Professional bodies and membership organisations that represent the STEM workforce also play an important role in the STEM landscape.

- New Zealand Institute of Food Science and Technology:
 - sponsors the *CREST PD challenge* which is a yearly competition for high school students to encourage them to be creative and create new food products
 - organizes a yearly factory tour for university students of food science and technology to inspire them to continue studying food science and technology and shows them the opportunities they could have
 - hosts a yearly career evening for university students with guest speakers from all around the food industry to give student tips on how to present themselves in an interview and the do's and don'ts when writing CVs

- is a sponsor of the *Auckland Science Fair*
- provides networking opportunities for students through our monthly branch meetings with free (or very low fee) attendance. Meetings encourage students to be confident and talk/communicate with people from the industry, increasing their employability.

<http://www.nzifst.org.nz/careers/default.asp>

- The Institute of IT Professionals (IITP): Advocates for IT in schools (and the organisers of ICT-Connect above) and actively links to the IT disciplines in tertiary education. <http://www.iitp.org.nz/activities/education>
- Working across industry sectors, the Workchoice Trust sets up annual opportunities for companies to showcase their organisation to senior secondary students through *Workchoice Day*.
<http://www.workchoice.co.nz/programmes/workchoice-day/>
With The Skills Organisation and Careers NZ, the Trust also provides *Teachers' Workchoice Day*, to showcase career opportunities for teachers who might not otherwise have the chance to understand the importance of STEM in today's workforce. <http://www.workchoice.co.nz/programmes/teachers-workchoice-day/>
- Intermediaries also include educators and organisations working to increase the amount and effectiveness of STEM education, for example NZ Council for Education Research. Their 2012 report *Science community engagement with schools* points to many similar issues to those discussed in this report.¹

5. Other STEM education initiatives

The STEM education space in Auckland also includes national education sector-led initiatives. The take up of these by Auckland businesses and education providers would need to be understood in a city-wide STEM growth strategy.

- The *Liggins Education Network for Science (LENScience)* has a vision for science and health literacy that it is promoting through curriculum linked projects for 11-18 year olds in partnering schools.
- *Science Learn Hub* sponsored by MBIE and hosted by Waikato University for Science teachers, up to year 10. <http://www.sciencelearn.org.nz/>
- The *National Science-Technology Roadshow* Trust aims to provide quality interactive learning experiences in science, technology and innovation nationally. www.roadshow.org

A central repository for STEM initiatives would be useful, to learn about and stay connected with initiatives from elsewhere, for example:

¹ Bull, A., Bolstad, R., Spiller, L (2012), *Science community engagement with schools*. Wellington. NZ Council for Educational Research.

- *Youth Into Industry* sponsored by Winstone Aggregates in Whangarei, has developed a very practical foundation course for high school students interested in pursuing a career in civil contracting and infrastructure. <http://www.youthintoindustry.org.nz/about-us/>
- In Christchurch, Linwood College is taking the opportunity of post-quake campus redevelopment to launch itself as the first STEM-focused school in New Zealand, piloting the approach next year with the first intake of Year 7 and 8 students.

6. Overseas STEM initiatives

There are STEM education projects everywhere. All the projects below were mentioned on the websites of companies contacted through this study.

- International projects that focus on coordination of STEM activities and highlighting successful strategies will be of interest to the Alliance, because of the emerging interest in having a STEM hub or clearing house function:
- *STEMconnector* is a Cisco initiative to improve coordination and knowledge transfer across STEM education organisations. STEMconnector identifies, records and analyses STEM programs across the United States, particularly those focused on minorities and women to see what is working. It takes a lead role in developing thought leadership about STEM education and acts as an information clearing house. <https://stemconnector.org/about>
- The *STELR* Project* is a national secondary school science education initiative of the Australian Academy of Technological Sciences and Engineering (ATSE) for year 9-10 students. STELR was developed to address the decreasing number of Australian students choosing to further their studies in the enabling sciences and mathematics. STELR is predicated on the assumption that many secondary school students drop out of science and maths because they don't think the subjects are relevant. STELR focuses on two key issues that most students are very concerned about – global warming and renewable energy. Orica, a global chemicals company operating here, is a partner in STELR. <http://stelr.org.au/>
- Cisco is also supporting *US2020*, a new initiative to encourage STEM mentors to offer longer-term programmes in low-income American middle- schools (our Years 7-10 – intermediate and early high school). Volunteer mentors work with students on practical projects for a term, focusing on engaging girls and minority families. <http://us2020.org/about-us>

There were international examples of student led STEM projects:

How can we encourage multi-national STEM projects to consider Auckland and NZ?

- *Students for a Smarter Planet* is a coalition of locally-based, student-led organizations, or individuals building a smarter planet sponsored by IBM. <http://asmarterplanet.com/studentsfor/about>
- Australian university students take interactive science exhibits to schools and town halls – a programme known as the *Shell Questacon Science Circus*. <http://www.questacon.edu.au/outreach/programs/science-circus>

Many online maths and science learning packages are being developed to increase focused learning over and above what schools can offer. One example is a *Spatial Temporal (ST) Math* program by the MIND Research Institute to help students master key math concepts and build problem solving skills (Cisco-sponsored) <http://mindresearch.net/about/>

There were other environmental education projects that may be of interest. For example, *Carbon Kids* is a project sponsored by Bayer in Australia that supports teaching and learning about climate change <http://www.csiro.au/resources/CarbonKids>

This list is only some of the examples of STEM education collaborative initiatives visible on the web. Some companies may be interested in exploring how to bring over to New Zealand STEM projects they are currently only offering in Australia.



Discussion

Who is investing in what?

Those companies that did invest in STEM education did so with varying degrees of intensity.

A small number of large companies were systematically linking into the education system to grow STEM skills. Clearly they saw investing in a STEM skills pipeline as supporting their core business. This investment was primarily focused on senior secondary and tertiary students. There was more specific mention of investment in engineering and ICT skills development in this group of companies than in science and maths. Engineering and IT companies tended to invest in STEM related to their own industries.

Funding scholarships was common, typically a cash contribution toward tertiary fees plus paid holiday work that had the potential (if the organisation fit was right) for future employment. Scholarships varied from \$1,000 to \$6000 per year. Tertiary scholarships for engineering were mentioned more than other subject areas.

Companies also offered opportunities for senior tertiary students and graduates through internships and graduate programmes. Some companies were recruiting school leavers through apprenticeships and cadetships. Upskilling existing staff in new technologies and technical processes was also mentioned as a STEM activity, although many would consider this supporting business as usual.

Companies supported STEM related competitions and events for secondary and tertiary students. These were usually organised by intermediary organisations. Competitions and events may be a common way of supporting science education but these may not be attracting Māori and Pasifika students. They may be more successful in inspiring students already started (or contemplating starting) with STEM.

Medium and smaller size STEM-linked companies were less likely to be investing. If they were, it was modest – offering an internship or staff time for taking the STEM message into schools via short talks offered by intermediary organisations.

Many STEM related businesses appeared not to be thinking about investing in STEM education. Investing for social responsibility was much more common. Companies were making financial contributions into a wide range of community activities across Auckland and nationally, particularly child wellbeing and environmental projects. This investment often had nothing to do with the company's core business. Companies probably start supporting particular programmes or causes because of personal connections between staff and the programme or because local organisations approached them.

Many companies don't think about investing in STEM education, even when they struggle to find skilled staff

Only a few businesses spoke about the need to recruit Māori and Pasifika, women or new migrants into STEM subjects and into their industries.

School and intermediaries

Very few companies referred to direct relationships with schools. Business were connecting to schools via intermediary organisations that provide industry-specific programmes that are intended to spark an interest in the students, making Intermediaries important players in the STEM education landscape. Intermediaries provide a straightforward way for companies to make a contribution to STEM education, because business does not have to deal with the organising and connecting with schools.

Businesses mentioned a number of ways they (indirectly) connected with primary schools including:

- Funding for environmental projects that involve field trips for school children (for example to the Zoo, dune planting, beach clean-ups, wetland rehabilitation)
- Young staff making annual STEM-related presentations to school classes
- Online teaching and learning resources related to the environment or personal health and wellbeing
- Setting up funds for sustainable education projects in schools
- Holding a fund that local schools could apply to for science resources.

Primary-focused environmental or wellbeing projects that link to the school curriculum have the potential to motivate students and start them on a STEM-related pathway. Whether that potential is realised will depend on whether schools regard involvement as one off events, or link the out of school experience explicitly to bigger curriculum programmes of work back at schools.

Businesses don't find approaching schools easy - they don't know what to offer and the timeframe schools take to make decisions is frustrating. Funding a community environment project is easier (and took less time) than developing a relationship with a school from scratch. No respondent mentioned an approach to them by a school about a STEM related opportunity.

Businesses commented on the pace of change in industry and the speed with which teachers (both secondary and tertiary) could fall behind industry knowledge. Only a couple of businesses mentioned staff going into tertiary programmes to teach or mentor students. A few companies mentioned taking part in events that provide professional development for teachers - usually set up by intermediary

organisations such as the NZ Association of Science Educators <http://nzase.org.nz/> or the Teachers' Work choice Day .

Opportunities

The conversations with companies highlighted that many companies haven't thought about whether they could invest or invest further in STEM education. Some want to do more, they just don't know what to do or how to do it. Many businesses are unlikely to go looking for how to invest in STEM ideas; intermediaries and students come to them.

This report has some examples of both large and small scale investment but in our brief interview, not many companies articulated the benefits they gained. Case studies that described the return on investment companies got from their STEM investment would be helpful, particularly if the case studies were from different sized companies and different investment levels.

More examples of different approaches to support STEM education would be also useful, particularly for small and medium companies who want ideas that are interesting and affordable.

There is scope to increase the number of STEM-focused scholarships for high school leavers moving to tertiary. The contribution to fees is greatly enhanced by the availability of work experience or mentoring.

Businesses could link more closely with tertiary programmes funding small-scale competitions, teaching on tertiary programmes and offering more mentoring of students completing assignments or practicums.

Mentoring is a highly effective strategy in other aspects of students' lives. It may be worth investigating whether STEM mentoring over an extended time is an effective strategy for growing students' subject interest.



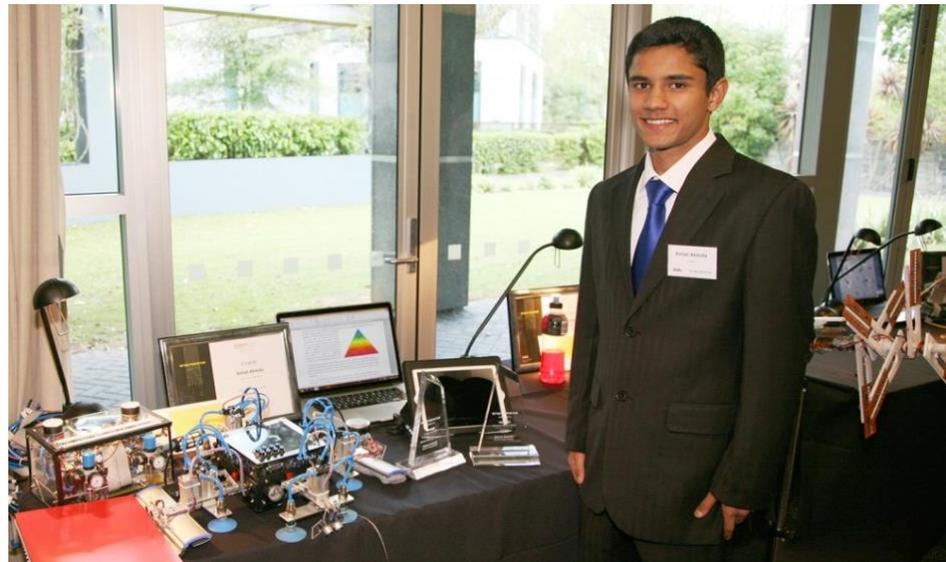
The insights and expertise of intermediaries, including subject teacher associations, would be valuable in developing a city-wide strategy for investing in STEM, particularly in relation to how schools work and how businesses can relate to and invest in education. There is potential for the Alliance to provide some coordination in this space. The different intermediary organisations don't appear to be connected themselves – they arise from different industry sectors, are in competition for funds and company contacts and there isn't a regional forum that brings them together.

The Alliance will need to take into account the size of the education landscape as it prioritises action. There are 89 secondary schools in Auckland. A focus on geographic school clusters, particularly around the new Vocational Pathways² may help with managing scale. Alternatively, if the intention was to focus on increasing Māori and Pasifika STEM engagement, there are 21 largely Pasifika high schools and 13 high schools with large Māori rolls.

There are also three major universities, two polytechnics, two wānanga and dozens of private training providers with an interest in the STEM skills pipeline.

Forthcoming Treaty of Waitangi claims in Auckland will change the Māori economic landscape and may well create opportunities for collaboration around STEM. Māori companies were not specifically sought out for this report but a BERL report on the Māori Economy, Science and Innovation illustrates the potential (Nana, Stokes et al. 2011)³.

It is beyond the scope of this report to establish either the dollar value of investment or the impact of that investment on companies in Auckland. As the Alliance sets a work plan and targets, it may become more evident just what data would be helpful and what ways might there be to measure that investment.



² <http://youthguarantee.net.nz/assets/Uploads/Vocational-Pathways-update-12-June-2013.pdf>

³ Nana, G., et al. (2011). The Māori economy, science and innovation, BERL.