Case Study 2022

Under the Strategic Science Investment Fund

Advanced Energy Technology Programme

"High Power electric motor for large-scale Transport"

Building capability and increasing the diversity in New Zealand's Research Workforce

Problem – Lack of diversity in New Zealand's Research workforce

New Zealand's Research Workforce lacks diversity. Aware of the situation, the government and other organisations have developed more targeted policies and initiatives and keep track of what is going on [1]. Diversity is more than just a matter of fairness and social harmony; multiple studies have demonstrated that diverse teams and organisations are more creative, have better problem-solving ability, and stronger governance [2].

Māori and Pasifika people are disproportionately underrepresented in New Zealand's research workforce today. The problem begins in high school and continues through university, but it becomes more obvious as careers progress. E.g. Māori and Pasifika students in Science/Technology/Engineering/Mathematics (STEM) disciplines at universities are over 2 times underrepresented compared to the general population [3]. It increases at the PhD level with 2-3 times [3,4] underrepresentation and is worst for permanent academic positions with less than 5% (Pasifika <2%) of academics across all disciplines being Māori versus ~17% (Pasifika ~8%) in the general population [4,5,8]. Similar numbers are present in the research workforce outside academia. E.g. only ~6% of physical science and engineering technicians and ~5% of architects and engineers are Māori (~2% Pasifika) [6,7]. These low numbers have the additional insidious effect of often putting the only indigenous staff member in a faculty/organisation under extreme pressure to help colleagues, indigenise curriculum, support indigenous students while also advancing their own career [8]. Besides Māori and Pasifika also female students, researchers and practitioners are considerably underrepresented, especially in engineering disciplines [4,7]

This lack of diversity is a complex problem, not one initiative, group or organisation can solve. It will take time and commitment to overcome. However, our MBIE funded Advanced Energy Technology Programme "High Power electric motor for

large-scale Transport" wants to be part of the solution. We developed and tested new initiatives along the STEM education chain. Our goal is to attract, support, mentor and keep students and researchers throughout the entire education system.

Our Approach - Custom tailored Student "Tech Bootcamps", targeted scholarships and mentoring of early career researchers

The first new initiative we launched in within in our programme was the Paihau—Robinson Tech Bootcamp. We were primarily seeking Māori and Pasifika year 12 and 13 high students with a passion for science, engineering & technology across Aotearoa. The idea is to show and immerse the students in a NZ research work environment. Our goal was to lower perceived barriers to enter university, particularly STEM disciplines, by making science and scientists more approachable. It also was the nucleus to create a network not only between us and the students but also the students themselves.

Since its launch in Dec 2020, Paihau has hosted 4 Tech Bootcamps in Wellington. This includes two summer camps (December 2020 and January 2022), and two iwi-partnered camps (Ngāi Tahu and Tauhara North No.2 Trust). We advertised two of our summer camps through public secondary schools. The iwi advertised the two iwi-partnered camps through their networks of registered members. The two iwi camps were planned in collaboration with senior iwi members, and some joined and supported the students during the bootcamp. Besides the positive effect in the perception of STEM disciplines, feedback revealed that some students also felt more connected to their iwi because of their involvement and support.

The bootcamp activities included visits of different laboratories from different groups and science backgrounds, including Robinson Research, Ferrier Institute, Victoria University, GNS. National Measurement standards and science related tours in Zealandia, Te Papa and Space Observatory. They also visited industry professionals as e.g. Llama Engineering, Lekkie bikes. The lab visits often included a component for the students to perform a small experiment and even building and programming their own robotic car.

Another programme initiative, facilitated by our programme partners Ara Institute of Canterbury and Manukau Institute of Technology, is aimed at Māori and Pasifika students, particularly at Polytechs. One component of our strategy is to provide scholarships to cover tuition fees for individuals from less affluent backgrounds so that they can study at a Polytech. The second component is the organisation and facilitation of summer internships in New Zealand businesses and research organisations. This will help to place more students in engineering careers, besides providing the student with industry experience. We tested a novel technique that worked well, facilitating a "speed dating session" between interested students and corporations to determine the best fit. Over both summer periods, COVID-19 complicated placements, particularly in Auckland. However, in 2021, we could put our first three students, one Māori, one Pasifika, and one female, in different companies. We will report on our achievements and details in a follow up case study "Developing industry ready graduates"

This participant's feedback quotes illustrate what we wanted to achieve:

“Working in the field and with very experienced members … I was able to gain knowledge that I can use for my engineering career and diploma. I have been able to make a strong connection with [the company].”

Finally, within our research team itself, we want to increase the number of Māori and Pasifika students and researchers and mentor them at the start of their career. So far, one former Māori PhD student has finished his PhD and started as a full time employed scientist at Robinson Research Institute and is also working in our programme. A second Māori PhD student has just finished his PhD (August 2022) and left to run a start-up company based on technology out of Robinson.

Student group in of Robinson Research Institutes Tech Bootcamp

Impact – Increased uptake of STEM disciplines and improved pipeline to increase diversity in NZ’s Research Workforce

In all 4 bootcamps, we had in total 50 participants from over 116 applications.

From the participants, 68% identified as Māori, 28% as Pacific Islanders and 4% as both, 48% were female and 52% male. Among the participants, we counted 12 different iwi affiliations.

Participants' feedback quotes illustrate what we wanted to achieve:

“It really helped me feel less anxious about moving to university and choosing future pathways.”

“[The best part] … for me it was connecting with like minded people from similar backgrounds. I don't have many connections like this back home so it's cool having friends in different places that I can relate to.”

"It has also just confirmed that a career in STEM is what I truly want to pursue!"

We will stay in touch with the participants to offer further support along their career path. We are running a Discord social platform community for any bootcamp alumni to join. So far, 7 of our bootcamp alumni have started to study at university, one at a

Polytech. Two of them are students at the University of Canterbury, and a UC programme team member has met and offered further support in the future.

We are now in a position where we can transfer and refine our method to other programme partners. For example, in 2023, we will have a South Island focused bootcamp at the University of Canterbury. Next, we intend to expand outside our programme to other programmes and organisations.

We now have a strategy and preliminary data for Polytech students to progress and further roll out our approach. Because of their internship, two of the three Polytech students received an offer from the hosting company to work for them. The team in our technical workstreams is also progressively interacting and collaborating with organisations and company in the transportation, electrical components, and cryogenic manufacturing sectors. This will aid in placing researchers and engineers in industry and we will explicitly target future high-tech jobs in the electric transportation sector.

In summary, we expect our initiatives will help to increase the number of STEM students, researchers, and practitioners from Māori, Pasifika background and other underrepresented communities. This will help to increase the diversity of Aotearoa's research workforce.

References

[1] https://ssip-data-cop.shinyapps.io/diversity_data_dashboard_ssip/ and MBIE "Diversity in science statement", August 2018.

[2] https://caseagrant.ucsd.edu/news/diversity-stem-what-it-why-does-it-matter-and-how-do-we-increase-it#:~:text=Why%20does%20diversity%20matter%20in,than%20the%20more%20diverse%20group.

https://hbr.org/2016/11/why-diverse-teams-are-smarter

https://www.weforum.org/agenda/2019/04/business-case-for-diversity-in-the-workplace/#:~:text=There%20is%20substantial%20research%20to,and%20better%20problem%2Dsolving%20abilities.

[3] https://www.educationcounts.govt.nz/statistics/population-data

[4] Royal Society report, "THE RESEARCH WORKFORCE OF AOTEAROA NEW ZEALAND" Research Community Workshop Briefing Paper and Workshop Outcomes, 30 November 2020.

[5] Why isn't my professor Māori? A snapshot of the academic workforce in New Zealand (2019). *MAI Journal: A New Zealand Journal Of Indigenous Scholarship*, *8*(2). doi:10.20507/maijournal.2019.8.2.10

[6] Katharina Ruckstuhl, Maria Amoamo, Ngaire Hiria Hart, William John Martin, Te Taka Keegan & Richard Pollock (2019) Research and development absorptive capacity: a Māori perspective, Kōtuitui: New Zealand Journal of Social Sciences Online, 14:1, 177-197, DOI: 10.1080/1177083X.2019.1580752 To link to this article: https://doi.org/1

[7] https://www.wsp.com/en-NZ/insights/diversity-key-to-the-future-of-engineering

[8] Tara G. McAllister, Sereana Naepi, Elizabeth Wilson, Daniel Hikuroa & Leilani A. Walker (2022) Under-represented and overlooked: Māori and Pasifika scientists in Aotearoa New Zealand's universities and crown-research institutes, Journal of the Royal Society of New Zealand, 52:1, 38-53, DOI: 10.1080/03036758.2020.1796103