Outcome of WITT model for EE2E (e2e) programme for Secondary School to Engineering pathways

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Introduction

According to the National Engineering Education Plan (NEEP) developed with guidance from tertiary educators, Industrial training Organisations (ITOs), industry stakeholders and the Engineering New Zealand. This report set out a national plan for ensuring that the right numbers of the right types of graduates are produced to meet New Zealand's needs (IPENZ, 2010).

The expected outcome of the plan is to increase in the number of engineering graduates by at least 500 per annum, for New Zealand Diploma in Engineering-NZDE (up 85%) and Bachelor of Engineering Technology-BEngTech (up 120%) than the BE(Hons) (up 5%). The Government established Engineering e2e in 2014 to find ways to draw more learners into tertiary study in engineering. It was particularly targeted in the NZDE accredited under the Dublin Accord and BEngTech accredited under the Sydney accord, to address New Zealand's critical shortage of engineers.

Tertiary Education Commission (TEC) NZ has started a pilot project Engineering Education to Employment EE2E (e2e) for workforce development approach focused on coordinating individual opportunities, organisational goals and national priorities for economic growth. This approach is distinct from a career development approach which provides information and support to help people manage their careers at different stages (Engineering e2e, 2018).

Purpose/Goals

The main purpose or goal of this paper is to discuss the outcome of WITT model of e2e. To engage and motivate the students from high schools to join engineering and to increase the student numbers in higher engineering education targeting more students from Maori, Pasifika and Women.

Approach/Methods

As this was competitive funding with different and unique model to each education providers according to their regional needs in increasing the engineering graduates. The Tertiary Education Commission (TEC) put more conditions to include female, Maori and Pasifika students in engineering and also to include secondary school physics and maths teacher.

The two-step process was adopted, the first step was to engage with the regional secondary schools to discuss in detail about the programme and outcome expected and to bring on board for the development of pathways of secondary school to tertiary education in engineering. This was initiated with the meetings of Polytech's engineering head/manager with the

Principals/Deputy Principals/Head of Physics/Maths/Technology of secondary school. The is to further develop the mapping of pathways from secondary school to tertiary engineering education for NZDE or BEngTech programmes from year 10 to year 13. The year 10, 11, & 12 was to introduce about engineering under STEM subjects with different activities.

The mapping is the unique characteristics for each Polytechnic to get the funding for year 13 students' engagement. The other important aspect was considered to make more lucrative to the students. This is to get more NCEA Level 3 credits under New Zealand Qualification Authority (NZQA) in either physics or technology in their year 13. This will facilitate the students to make decision for choosing their higher engineering studies

The Western Institute of technology at Taranaki (WITT) has mapped NCEA Level 3 of total 8 credits and plus 15 credits of NZDE. The aim is to attract students in NZDE programme with the 15 credits in 13 year of their school and to give them a head start in the beginning of NZDE with one paper minus in the semester 1 of the NZDE or BEngTech. The 15 credits of NZDE was offered as one paper named Engineering Fundamentals which is common for Civil, Mechanical, Electrical, Electronics, Computer, Mining, Clinical and Fire Engineering strands of NZDE and Mechanical, Electrical, Civil and Mechatronics strands of BEngTech programmes

Second step is to evaluate the performance with the feedback from the schools about the performance of the outcome achievement of WITT model and TEC contracted third-party evaluation about the outcome of each Polytech's for NZDE and BEngTech which gives significant indication of participation of Maori, Pasifika and Women students refer to the details in the actual outcome section.

One of the feedbacks from the Francis Douglas Memorial College, New Plymouth states that *"WITT's Engineering Education 2 Employment (EE2E) programme which has been running successfully since 2017. EE2E is an inspirational and innovative programme that encourages more students to study engineering. It promotes the NZ Diploma in Engineering as an entry point into the industry or a stepping stone to higher engineering qualifications.*

WITT consulted and listened to what would work from a school's perspective and made a real commitment to develop a model that would work for our school students. This model has allowed our students to continue to achieve academically at school, whilst also being able to attend a tertiary institute to further develop their understanding and learning about engineering.

EE2E has made connections with engineering companies and initiated visits to the workplaces for our students. There are benefits for all involved. It has helped students realise the importance of the STEM subjects and students have spoken specifically the knowledge the course has given them which has been of use in their Level 3 Physics classes".

The other feedback is from the support letter for Engineering New Zealand's ENVI Award for engineering education award participation states that "*Engineering Education to Employment (EE2E) programme established at WITT in 2017 following a Pilot funding award from the TEC. Partnering initially with 4 Secondary Schools in Taranaki (later growing to 7 partner schools), an exciting multi- faceted programme was created to engage students and make them aware of the opportunities presented by choosing Engineering as a career.*

This unique programme encouraged engagement from priority population groups being Maori, Pasifika and Female students between Years 11 and 13. It supported students with their transition to Tertiary studies, complimented their Secondary Maths and Physics Curriculum and gave them an introduction to the basis of Engineering and the requirements of study at this level". The relevant concerned permission has obtained for the privacy Act to publish the publish the information

The significant impact is that EE2E programme is gaining popularity amongst the students in the region which is directly related to the enrolment in higher engineering programme at ITPs and Universities.

The feedback and appreciation were very encouraging from the schools about the e2e programme. Although, there is no funding from 2019 by TEC but the programme is still continuing due to popular demand from the regional secondary school students aspiring for higher engineering education in New Zealand.

Actual Outcome

The actual goal of e2e is to have 500 per annum was met by 2017, but the increase was largely due to increases in the number of BE(Hons) graduates. Progress in delivering the forecast number of NZDE and BEngTech graduates has been more subdued although such graduates are making up a larger share of completions. This project was part of a stream of work that aims to grow the pipeline of engineering graduates, particularly of Engineering Technicians (NZDE graduates) and Engineering Technologists (BEngTech graduates).

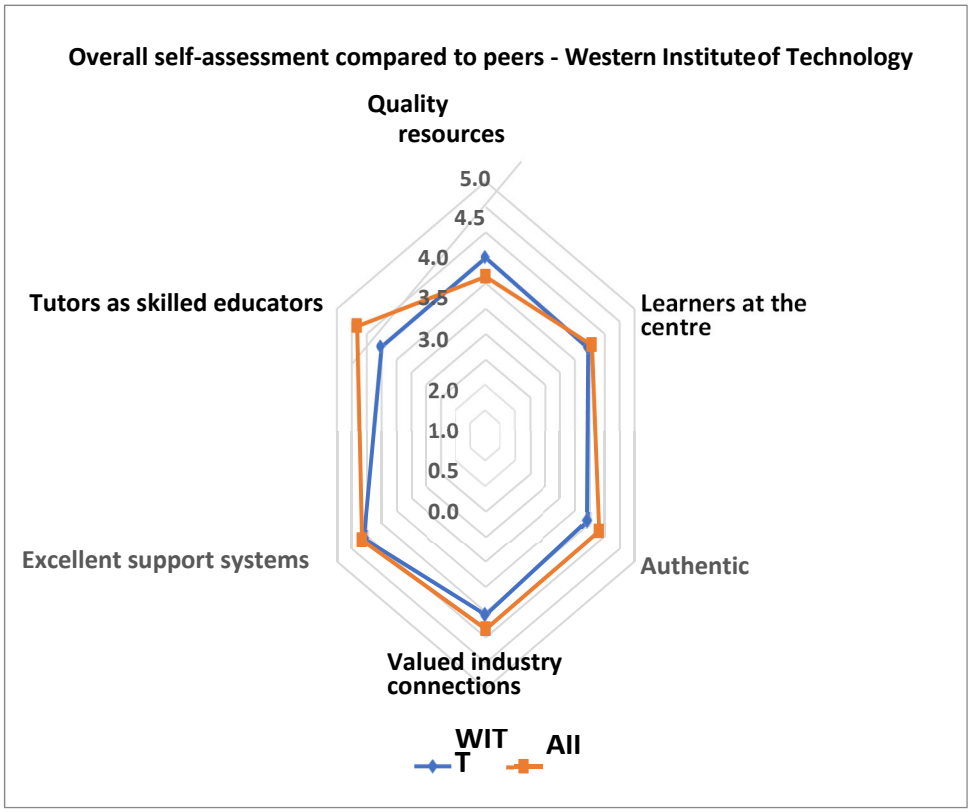
There were 2,365 learners enrolled in the NZDE in 2017, an increase of 34% or 600 learners since 2013. The growth in learners predominantly reflects growth in international learners (up 143.7%) rather than domestic learners (up 7.4%). NZDE learners tend to be male (90.7%), non-Māori, non-Pasifika (84.0%) and aged 18-29 years (78.8%) (Mischewski & Edmonds, 2019).

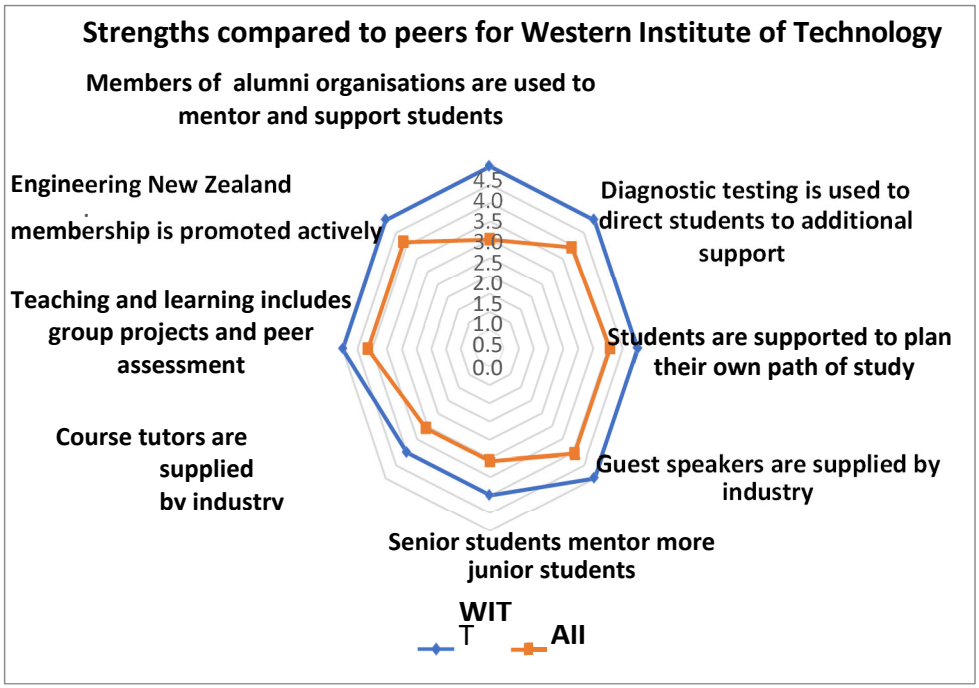
There were 1,799 learners enrolled in the BEngTech in 2013. Enrolments peaked at 1,930 in 2015 before declining to 1,739 by 2017, an overall decline of 3.3% or 60 learners since 2013. The overall trend conceals a more marked decline in enrolments at ITPs over the same period of 8.8% as enrolments grew at the sole university provider. BEngTech learners also tend to be male (90.9%), non-Maori, non-Pasifika (78.3) and aged 18-29 years (79.8%) (Mischewski & Edmonds, 2019).

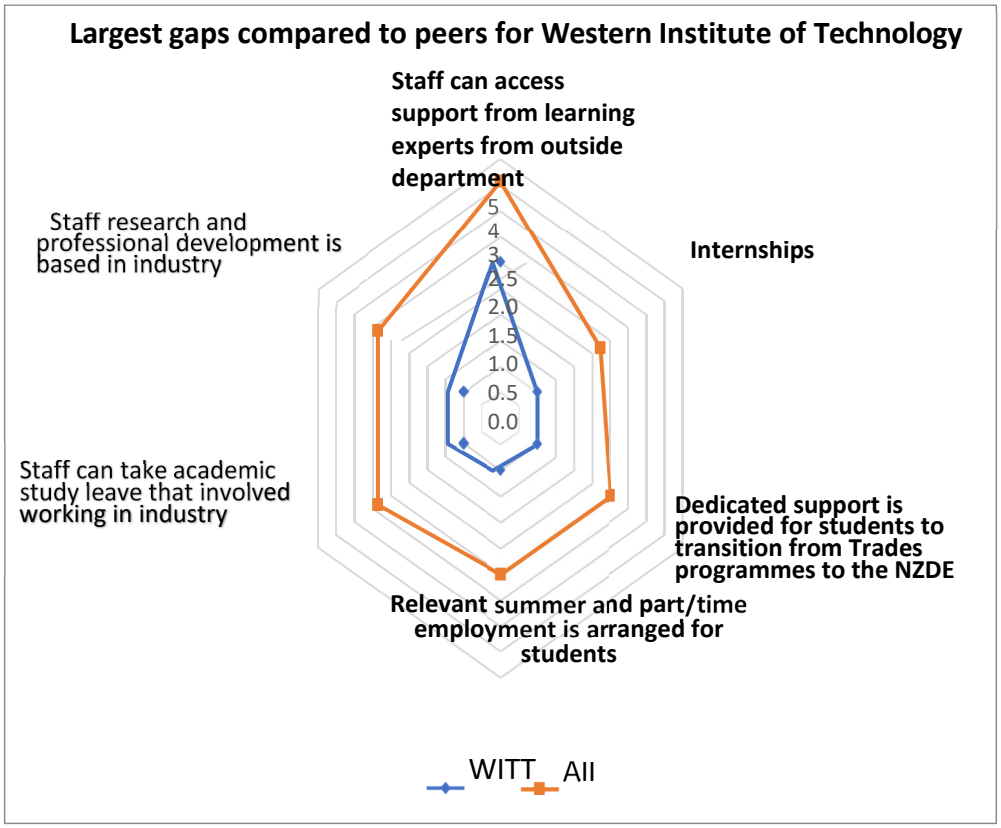
Along with some other providers of vocational education and training, some providers of the NZDE and BEngTech face challenges generating cohorts

large enough to be economically viable in the long term. Negative perceptions of non-university qualifications affect the number of learners recruited into the NZDE, which in turn constrains the level of available resourcing and affects public and employer perceptions of graduates (Mischewski, 2017), (TEC, 2018).

The outcome from third party report for TEC for evaluating the performance of each Polytech's as mentioned in the methodology section is given below with in figure 1 followed by the participation data given in the figure 2.







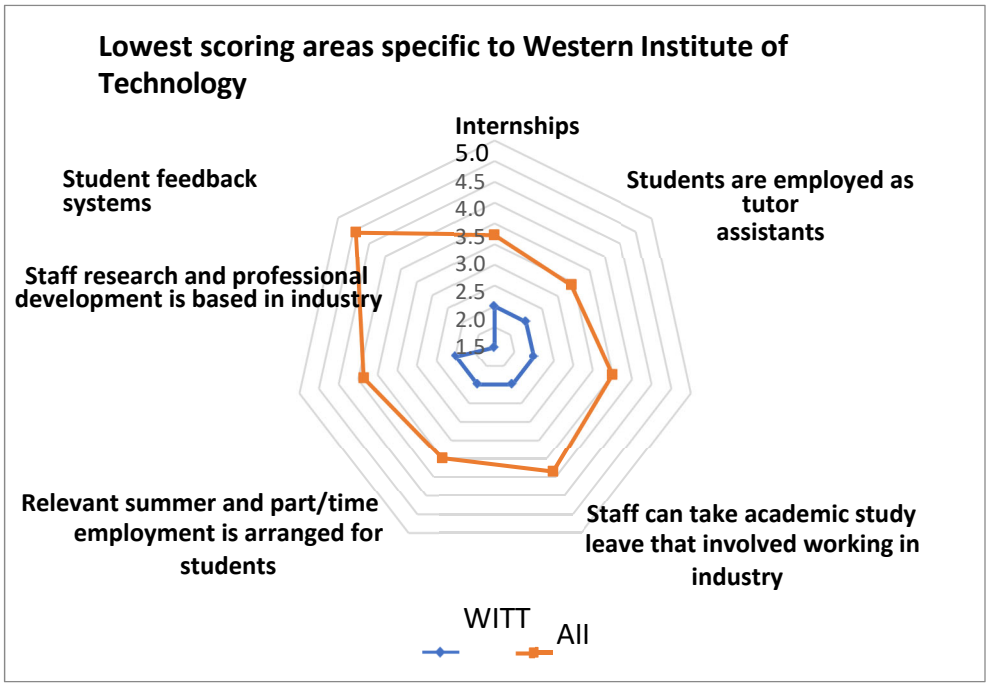


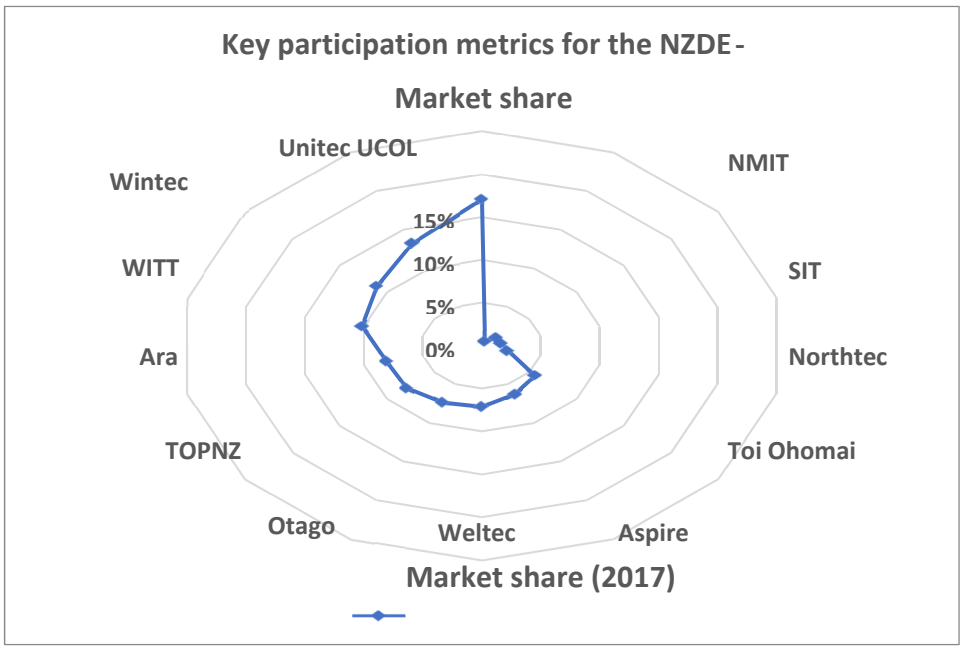
Figure 1: Comparative results of WITT with other Polytechnics in NZ

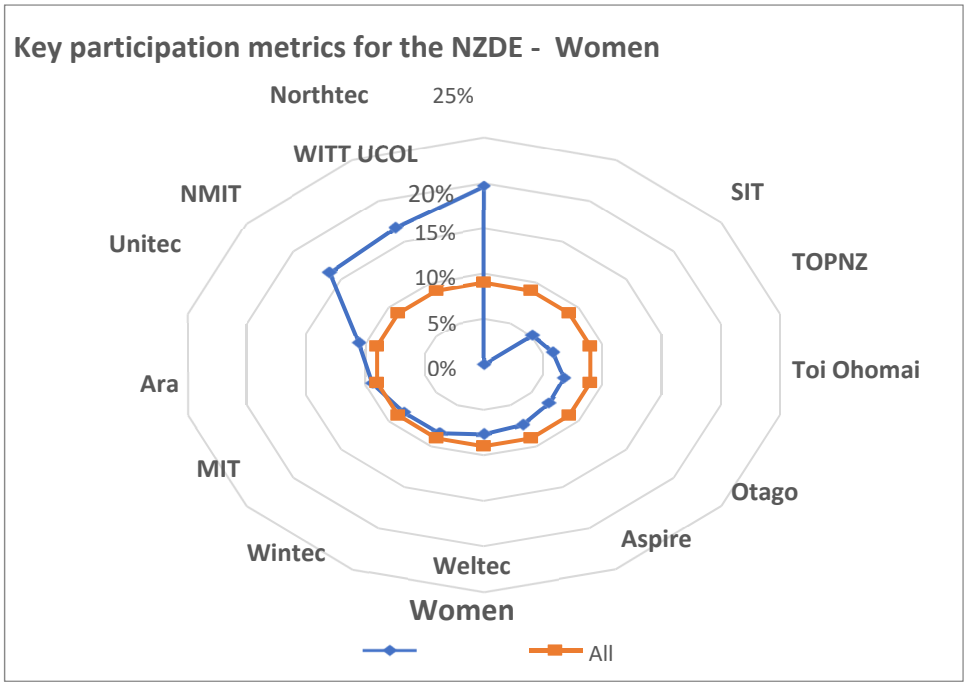
The results suggest that:

- ✓ your organisation's overall use of the practices identified in the good practice guide is comparable to your peers albeit with markedly slightly lower use of practices relating to the support of tutors.
- ✓ your organisation is particularly strong in terms of support systems such as diagnostic testing of learners and use of alumni for mentoring, steps to put learners at the centre such as supporting them to plan their own programmes of study and senior students mentoring more

junior students, and connections to industry through guest speakers and course tutors supplied by industry. Promotion of Engineering New Zealand membership and group projects and peer assessment are also strengths.

- ✓ relative to your peers your organisation is less likely to provide opportunities for staff to access support from learning experts and take academic study leave in industry, connect with industry through relevant staff research and professional development and arranging summer and part-time employment and offer internships and support learners to transition from trades training.
- ✓ besides those noted above your organisation is less likely to make use of student feedback systems than your peers.





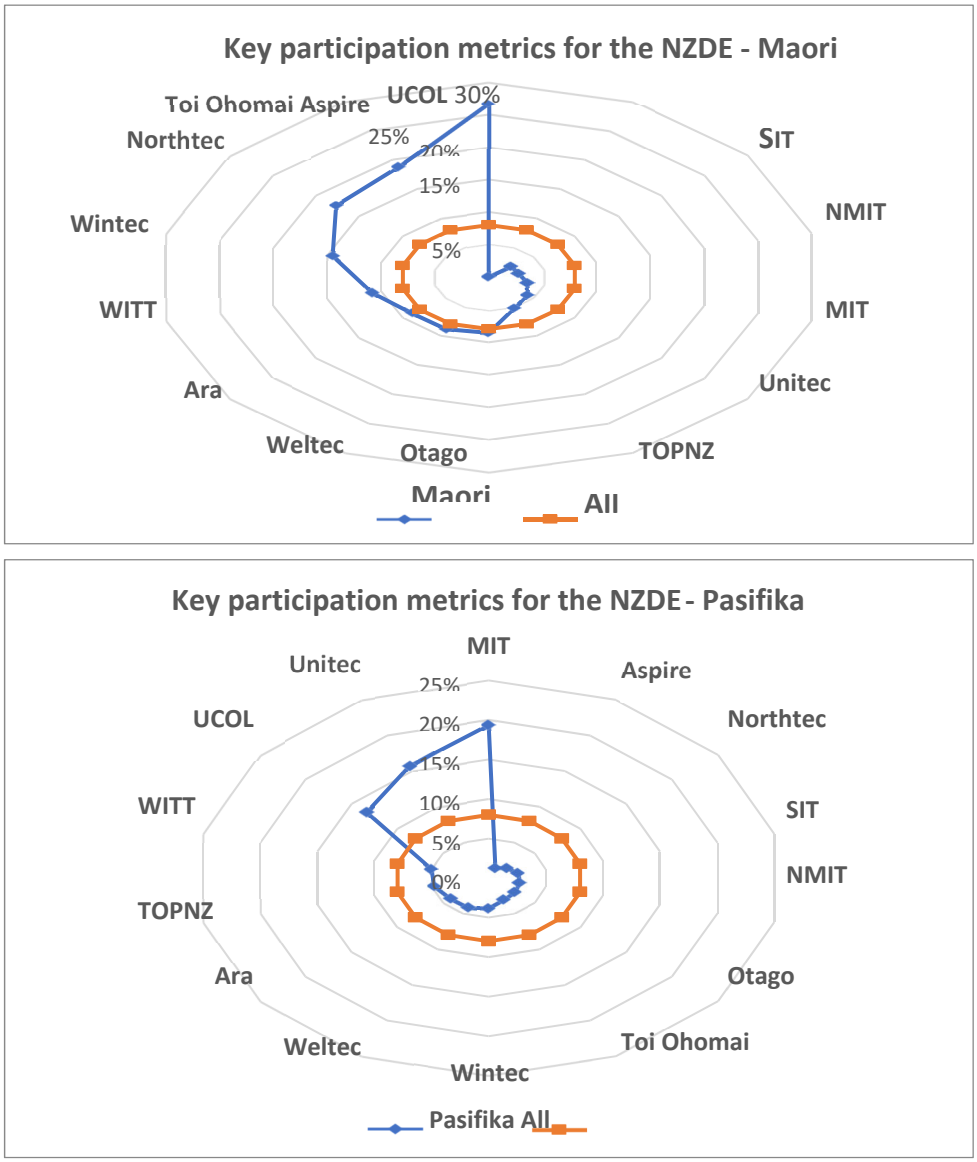


Figure 2: NZDE Participation data – comparative results

Results - Participation data

The results suggest that your organisation:

- ✓ accounts for 10% of all enrolments in the NZDE.
- ✓ attracts the second highest proportion of women to the NZDE compared to your peer organisations.
- ✓ attracts a higher proportion of Māori to the NZDE than the average for your peer organisations.
- ✓ has among the lowest proportion of Pasifika enrolled in the NZDE

Conclusion

Although, the EE2E (e2e) was particularly aimed at increasing the graduate's number in NZDE and BEngTech, there was a mixed outcome for engineering enrolment. There is a moderate increase in NZDE enrolment whereas BEngTech has gone down significantly, however there was an increased in BE(Hons). This mixed bag of outcome still very significant in improving the number of engineering graduates in New Zealand with loads of lesson learnt.

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Acknowledgements

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