

Integrating the systems

What differentiates Engineering Education-to-Employment (Engineering e2e) from other initiatives? We're trying something new – Integrating systems that enable collaboration between and across industry and education sectors – and it's succeeding!

Why establish a new programme?

The shortage of engineers in New Zealand is not a recent issue. Existing programmes were having some success promoting STEM careers, but the need for more engineering graduates has become increasingly urgent.

“It was obvious from the start that a new approach was required,” says Engineering e2e Steering Group Chair Sir Neville Jordan. “Engineering is a major driver of innovation and we decided to take an innovative approach to supporting engineering education and making a positive change across the system.”

“We needed much more than a careers promotion programme. Raising awareness of engineering and alternative pathways into engineering careers was fundamental to achieving our goal, but we were also charged with implementing systemic change. Engineering e2e is therefore integrating systems based on collaboration within and across the school, engineering education and industry sectors.

“As an impartial body, we are well placed to work with these sectors. Over the past four years, we have built up an understanding of their complex needs and leverage their expertise to provide solutions. Engineering e2e's approach focuses on building a sense of ownership, empowering educators and employers to continue working together to improve things. Early evaluation of Engineering e2e shows that this approach is worthwhile.”

An increase of 500 engineering graduates requires 3,800 more students doing Maths and Physics at NCEA Level 2, and then 625 more students enrolling in tertiary engineering qualifications:

A strong evidence base

Engineering e2e was founded on reputable national and international research – a strong evidence base has informed the approach we've taken in developing the programme and initiating each project.

The [National Engineering Education Plan report \(2010\)](#) produced by Engineering New Zealand (formerly IPENZ) informed the establishment of Engineering e2e. It forecasted the need for more engineers, especially NZDE and BEngTech graduates, for 'business as usual' and to build an innovation-led economy.

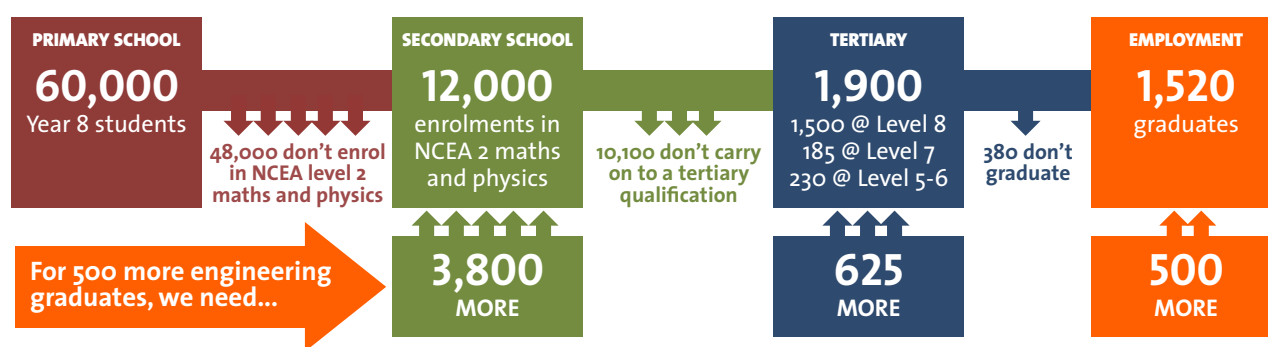
The McKinsey Centre for Government's report [Education to employment: Designing a system that works \(2013\)](#) (and its follow-up [Education to employment: Getting Europe's youth into work \(Jan 2014\)](#)) was a key influence on the programme design. It considered the high levels of youth unemployment and shortage of people with critical job skills, and concluded that the current education-to-employment system fails for most employers and young people.

THREE INTERVENTIONS

The McKinsey report recommends three interventions to integrate the systems:

- 1. Collect and disseminate data:**
 - to educate stakeholders
 - to build transparency
 - to manage performance.
- 2. Initiate more sector-wide collaborations:**
 - to build industry consensus
 - that share costs of improving education and training.
- 3. Create an education-to-employment 'systems integrator':**
 - that coordinates, catalyses and monitors activity.

The education to engineering pipeline – from school to graduation



INTERVENTION 1: COLLECT AND DISSEMINATE DATA

McKinsey noted that transformation requires good information, and that fewer than half of the youth they surveyed said they had the right information to decide whether to pursue further education or understand which programmes offered the best economic returns. “Young people need to be able to make informed choices about their career and education. In some cases, this may simply be a matter of aggregating data that already exist but are scattered among different sites.”

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Educating stakeholders

Engineering eze uses and shares data produced by other organisations or initiatives, such as TEC, Vocational Pathways, Occupational Outlook and My Qual.

We regularly communicate with stakeholders, publish a [monthly newsletter](#), and share information and stories on our [website](#). Engineering eze continually seeks feedback on our projects and communications, and invites suggestions about how we could extend or improve our activities.

Building transparency/Managing performance

The data we gather and share is also important to managing our performance – and that of the partners involved in our projects. It informs our work plan, in terms



of selecting which issues to concentrate on and how we will implement our projects. We also use relevant external data to evaluate those projects and monitor how our activities contribute to the common goal of growing more engineers to benefit New Zealand’s economy. We seek advice and new ideas from wherever they’re available and interpret them for the engineering sector. We don’t work on the projects themselves; we commission experts to do that.

Setting up each project involves: researching the problem, researching possible solutions, talking with stakeholders to contract an expert, delivering each project in stages – it’s an iterative cycle of trial and evaluation. This model will work in any system and will benefit the wider system.

INTERVENTION 2: INITIATE MORE SECTOR-WIDE COLLABORATIONS

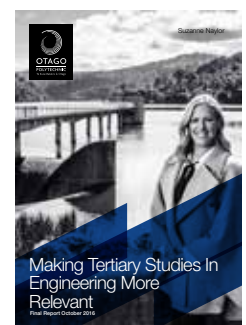
Employers and their workplaces are critical components of engineering education and training systems. McKinsey notes that “almost half of employers surveyed said they did not work with providers on matters such as curriculum design and teacher training. Even among those who did, partnerships are decidedly limited; only a minority report getting in touch as often as once a month.” It goes on to state that “The most transformative partnerships we have seen involve multiple providers and employers.”

Getting engineering employers and educators working together is therefore a core part of Engineering eze’s programme. Sector-wide and cross-sector collaboration contribute to projects aimed at delivering more Level 6 to 7-qualified engineers with the specific knowledge, skills and capabilities needed by employers. We have established good working relationships with many employers, and signed Memorandums of Understanding with IPWEA (Institute of Public Works Engineering Australasia), IET (Institution of Engineering and Technology), IMechE (Institution of Mechanical Engineers), EEA (Electricity Engineers Association), IFE (Institution of Fire Engineers) and Business NZ.

Graduate capability work

Industry leaders attended an Engineering eze workshop in which they discussed a Professional and Graduate Capability Framework developed by Emeritus Professor Geoff Scott – see [Graduate capability work](#). They considered the capabilities valued by their sectors, including the perspectives of successful early graduates, and recommended they be incorporated into engineering education.

Engineering eze commissioned Otago Polytechnic to research the Framework within the New Zealand context. The report [Making Tertiary Studies in Engineering More Relevant](#) recommended that tertiary education organisations implement changes, including collaborating with industry, to incorporate the teaching of capabilities within their programmes. Ara Institute of Canterbury (Ara) continues this work in 2018.



INTERVENTION 3: CREATE AN EDUCATION-TO-EMPLOYMENT SYSTEMS INTEGRATOR

“It’s hard to know where you’re going if you can’t see the road, and in the case of education-to-employment, no one has a good view of the whole journey.”

The McKinsey report defines a systems integrator as responsible for taking a high-level view of the diverse and fragmented education-to-employment system. “The more complex the web of stakeholders, the more difficult it is to see how the system is functioning. Getting such a perspective is critical; that is why we believe there should be a systems integrator.”

And that, says Engineering e2e Programme Lead Angela Christie, is our role. “We could be any sector but we are engineering. Our responsibilities reflect those recommended in the report: coordinating and integrating all activity, from R&D to the implementation of solutions; catalysing stakeholder action in priority areas; and monitoring and managing the quality of outcomes.”

Engineering e2e’s work is made more successful by the level of engagement and commitment of those involved, particularly as part of the Engineering e2e Steering Group. This group of committed engineering educators and employers, professional organisations and sector leaders guide and oversee our programme. Their contribution and preparedness to take risks has made a big impact on our achievements.

Coordinating, catalysing and monitoring activity

Barriers to studying engineering

Before initiating any major projects, Engineering e2e commissioned research into why young people are not choosing to study engineering and the lack of interest in the BEngTech. The report [Engineering Barriers and Responses \(2014\)](#) made a number of recommendations which included: making engineering as a career more attractive, reaching school students earlier, and using industry to educate the educators.

To highlight why so few students have the requisite knowledge to study engineering and show how educators and employers can make a difference, e2e has published a range of material; for example, the [Make the World discussion document \(2015\)](#) and the [Engineering pipeline diagram \(2015\)](#). We also produce documents for specific stakeholder audiences.

Despite the good work done by various organisations, there are still many parents, students and teachers who don’t know what engineers do or that there are different pathways into an engineering career. We launched our



Begun in May 2016, the Make the World campaign has delivered excellent results, with a positive perception of engineering increasing from 31% to 52% amongst potential students (with Māori and Pasifika increasing from 25% to 55%) and engineering moving from the 10th most considered career to 3rd, with 34% of females now seeing it as a possible career, up from 11%.

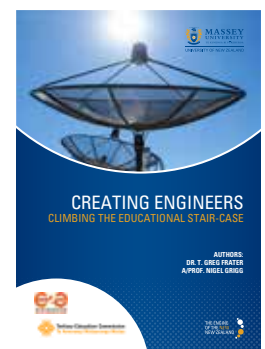
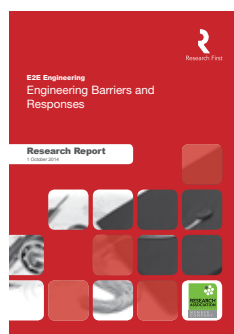
public awareness campaign [Make the World](#) in mid-2016 to raise awareness of engineering and the opportunities with an engineering career. It focused on NZDE and BEngTech qualified engineers, and surveys indicate it was successful in raising engineering as a career students would potentially consider. However, it highlighted a perception issue facing the ITP sector and didn’t influence their enrolment numbers at Level 6 and 7, and we still have work to do to address the balance of graduates across the NZDE, the New Zealand Diploma in Engineering Practice (NZDEP), the BEngTech and the Bachelor of Engineering with Honours (BE[Hons]).

Degree apprenticeships

Engineering e2e commissioned research into degree apprenticeship models of learning in the New Zealand context, and TEC is now funding a pilot programme. Employers played a key role in identifying and developing a Level 7 Infrastructure Asset Management standard for the pilot.

See: [Report: Stepping into one another’s world \(2015\)](#), [Report: UK degree apprenticeships: A year in review \(2017\)](#) and [Case study 67: A pilot sponsored degree programme](#).

Another commissioned report, [Creating engineers: climbing the educational staircase \(2016\)](#), identified the need to address the issue of “lack of feedback and communication and control”



within the engineering educator sector supply chain and proposed the set-up of regional education groupings.

In response, Engineering eze has funded a feasibility study by the University of Canterbury and Ara of an **Engineering education hub** which would involve employers, secondary schools and industry Training organisations (ITOs).

Micro-credentials

We engaged with engineering education providers, employers of engineers, professional associations and policy agencies, and commissioned a research report that found that many of the elements needed for micro-credentials to succeed are in place in New Zealand. Engineering eze has agreed to fund eight micro-credentials feasibility studies in 2018.

See: [Micro-credentials in engineering education](#)

Secondary-Tertiary Pathways Project

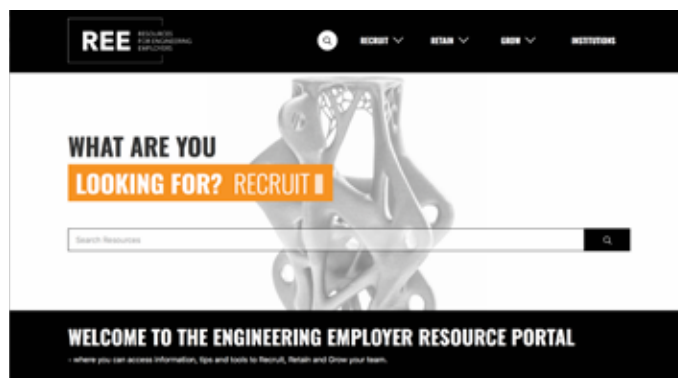
In 2016, Engineering eze invited ITPs (Institutes of Technology and Polytechnics) to apply for funding. Six of the 27 applicants were awarded funding to work in partnership with local secondary schools to deliver

programmes which will prepare and pathway students to enrol in and successfully complete tertiary engineering study. Each programme has also involved making links with local industry.

See: [What We've Learnt: Developing Secondary-Tertiary Programmes](#)

Resource portal for engineering employers

Business NZ and Engineering eze's new resource portal at www.ree.org.nz gives engineering employers a single access point for the latest tools to recruit, retain and grow employees. There are national and international examples of good practice that support the development of a diverse engineering workforce. The portal is a form of 'how to' guide, with examples of what others have done.



NEW OPPORTUNITIES

Continuing our work with employers

Evaluation tells us that a designated integrator has an important role to play in supporting the engineering education-to-employment system. Our workforce development approach focused on coordinating individual opportunities, organisational goals, and national priorities for economic growth. Now, Engineering eze's ongoing challenge is to increase the number of Level 6 and Level 7 graduates. To help achieve this, we have identified six key initiatives for the next two years:

- » Micro-credentials
- » A diverse engineering workforce
- » A new approach to qualifications delivery
- » Continuing our work in the compulsory education sector
- » Growing the pipeline of work-ready engineers
- » Engineering education hubs – a new system?

Our discussions with small-to-medium engineering firms show that many are unaware of the value in hiring NZDE

or BEngTech graduates. We believe there is a great need to continue educating employers about the differences between the three qualifications.

Following consultation with industry, we have added [A guide to engineering qualifications](#) to our website. This outlines the different types of engineering qualifications in New Zealand and broadly defines the kind of work a graduate would be qualified to do.

Diversity in engineering education and workplaces

Engineering eze is funding Te Tapuae o Rēhua to implement a programme that will more than double the number of Māori engineering graduates from Ara Institute of Canterbury and Otago Polytechnic by 2021.

This project leverages collaboration between Ngāi Tahu, key industry employers, engineering tutors and students to create successful engineering education and employment outcomes.

FIND OUT MORE...

The [Engineering eze website](#) explains who we are and what we do. [Info sheets](#) offer an overview of each initiative we fund. Our [monthly newsletters](#) and [progress updates](#)

keep all stakeholders up-to-date with Engineering eze research, publications, initiatives and relevant issues.

Inquiries: tel 04 462 5392, email engineeringeze@tec.govt.nz