

# Integrating the systems

What differentiates Engineering Education-to-Employment (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 isn’t a recent issue. Existing programmes were having some success promoting STEM careers, but the need for more engineering graduates was becoming increasingly urgent, particularly in the light of the Government’s Business Growth Agenda priority of building a more productive and competitive innovation-led economy. The Government set a goal of increasing engineering graduates by 500+ per annum by 2017, and the Tertiary Education Commission established Engineering e2e in mid-2014 to help achieve this.

“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 obviously 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 three years, we have built up an understanding of their complex needs, and used that and their expertise to provide solutions. Our approach focuses on building a sense of ownership, empowering educators and employers to continue working together to improve things. Engineering e2e will be evaluated later this year, with a report available in late December.”

## 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 the Institution of Professional Engineers New Zealand (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.

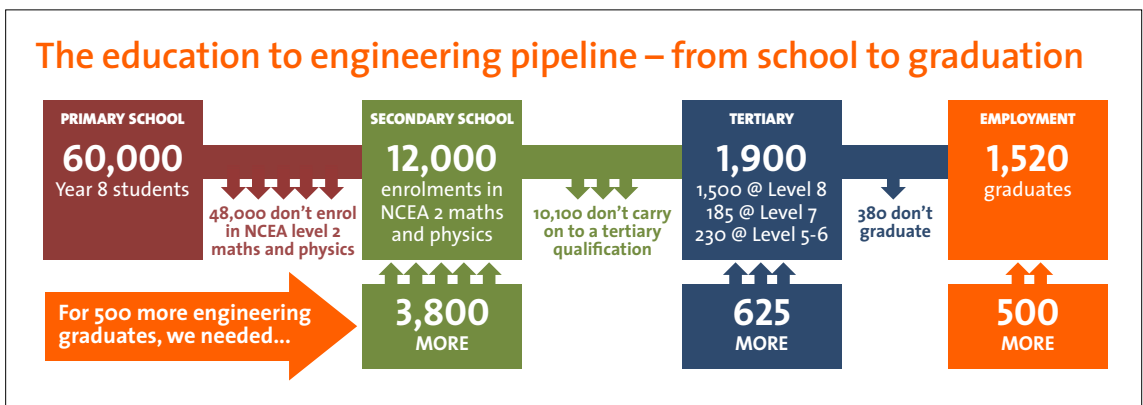
The McKinsey Center for Government’s report [Education to employment: Designing a system that works \(2013\)](#) (and its follow-up, [Education to employment: Getting Europe’s youth into work \(2014\)](#)) was a key influence on the programme design. The report considered the high levels of youth unemployment 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 to integrate the systems

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 Government’s goal was demanding: to achieve 500+ more engineering graduates, we needed 3,800 more students doing maths and physics at NCEA Level 2, and then 625 more students enrolling in tertiary engineering qualifications.*



## 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.”

### 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 also collaborate with [Careers NZ](#) and [Futureintech](#).

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 noted 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 collaborations 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) and IET (Institution of Engineering and Technology).

### 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.



### 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.”

McKinsey 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 those on 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 \(2015\)](#) – see page 1. 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%.*

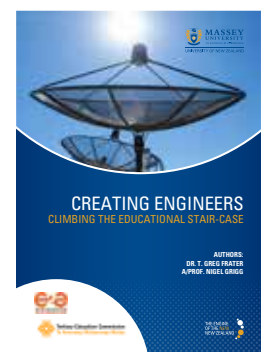
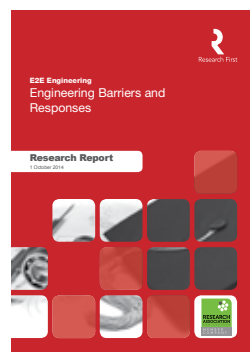
public awareness campaign [Make the World](#) in mid-2016 to raise awareness of engineering and the opportunities with an engineering career. It focused on NZDE- and BEngTech-qualified engineers, and surveys indicate it was successful in raising engineering as a career students would potentially consider.

##### Sponsored degrees

Engineering e2e commissioned research into sponsored degree (degree apprenticeship) models of learning in the New Zealand context, and TEC is now funding a pilot sponsored degree programme. Employers are playing 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 70: 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 education sector supply chain and proposed the set-up of regional education groupings. In response, Engineering e2e has begun work to develop [Engineering education hubs](#) which would involve employers, secondary schools, universities, ITPs and ITOs.





## Micro-credentials

As part of our Excellent Teaching and Learning in Engineering project, Engineering eze is looking at the place of micro-credentials [competency-based, personalised, formal or informal units of learning] in Levels 4 to 6 engineering education. This includes assessing how micro-credentials might be tailored to the New Zealand context. See: [Report: Micro-credentials: A model for engineering education?](#)

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## NEW OPPORTUNITIES

Less than three years after being established, Engineering eze is increasingly recognised as a linchpin, bringing together the engineering education and industry sectors. Having achieved, a year early, the Government goal of 500+ more engineering graduates by 2017, our next goals include increasing the numbers of NZDE and BEngTech graduates, ensuring learners have a smooth educational pathway from diploma to degree to honours, developing a resource portal for employers and examining and implementing ways to make our education and employment sectors more diverse.

### Increasing the numbers of NZDE and BEngTech graduates

The key to this is ensuring school students have transparent, meaningful pathways and the information they need to make the right decisions for tertiary engineering study that matches their career aspirations.

Our [Secondary-Tertiary Pathways Project](#) shows that there is much to be done in collaborating with secondary school teachers and careers advisors to teach Science,



*Unitec's Secondary-Tertiary Pathways Project involves 41 students from six West Auckland schools – Massey High School, St Dominic's College, Green Bay High School, Kelston Girls' College, Kelston Boys' High School and Waitakere College. With two girls' schools involved, there's a good gender ratio – 18 students are female. One-third of the entire group identifies as Māori or Pasifika.*

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## FIND OUT MORE...

The [Engineering eze website](#) explains who we are and what we do. Progress reports on all our initiatives can be found at [www.engineeringeze.org.nz/Progress](http://www.engineeringeze.org.nz/Progress).

## Secondary-Tertiary Pathways Project

Last year, Engineering eze invited ITPs (Institutes of Technology and Polytechnics) to apply for [Secondary-Tertiary Pathways Project](#) funding. 27 applied, with six 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.

Maths and Technology within an engineering context – enabling students to enrol in and complete engineering qualifications.

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 and are currently running a [survey](#) asking employers about their recruitment practice.

### Resource portal for engineering employers

We have also identified the need for a resource portal to give employers a single access point for the latest tools to recruit, retain and grow employees in engineering. The portal would include research, examples of good practice and other material. We have started a scoping project to find out what tools they want and how they wish to access them.

### Diversity in engineering education and workplaces

Diversity is another concern – we have a shortage of engineers and untapped potential in the form of female, Māori and Pasifika students who are much less likely to consider a future in engineering.

Engineering eze is well positioned to continue and extend efforts to ensure these students are enabled to consider engineering study and be prepared for it and to help employers to recognise the value of a more diverse engineering workforce.

It is not only the engineering sector that can benefit from our work. We can share the broad lessons learnt during this project to support change within the wider system.

Our [monthly newsletter](#) keeps all stakeholders up to date with Engineering eze research, publication and initiatives and relevant issues.