Aligning Environmental Engineering Education With National Needs

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Background

- New Zealand lacks a tradition of Masters degree in environmental engineering as the standard pathway for professional development
- Advantage of allowing individuals with a wide variety of educational backgrounds to practice as environmental engineers
- Disadvantage of requiring young engineers to gain a large amount of knowledge on the job, forestalling their quick advancement to high levels of expertise
- Opportunity to reassess how environmental engineering education can be better aligned to New Zealand's needs

Drivers

- Structural, geotechnical, and fire engineers in New Zealand are moving towards a registration system based on a competency assessment against a specific Body of Knowledge
- Supported by Masters degrees that are practitioner-focused and accredited by Engineering New Zealand
- Currently public stakeholders and engineering clients have no clear idea of the competencies that environmental engineers have in various specialisations
  - One attempt is the “suitably qualified experienced practitioner” required in contaminated soil assessments.
- No clear expectations by profession of how tertiary institutions should teach environmental engineering
- Potential for the profession to suffer from a failure (such as, arguably, the Havelock North example) is high

Master of Environmental Engineering

- **Broad coursework**

  Project management, transport engineering, geotechnical engineering, water resources, waste and waste water treatment sustainability, solid waste management, hazardous waste management, industrial ecology, civil engineering design practice, research thesis project

- **Strong practitioner links**

  60 days of Environmental Engineering related industrial experience

Mark's Masters

College of Engineering
UNIVERSITY OF WISCONSIN-MADISON

- **Broad coursework**

  Solid waste management, water analysis, water chemistry, industrial pollution control, biological wastewater treatment, statistical experimental design, hydrogeology, systems for envir. eng., applied research thesis project

- **Strong practitioner links**

  Summer team project, site visits, locally-funded research, funded attendance to WEFTEC, strong lab. work

Challenges to NZ Masters Degrees

- 20-40 students per year expected for a viable programme at the Masters level
- To reach a viable number of students, it is common for NZ universities to look to attract foreign students to a Masters programme.
- This poses two major challenges:
  - If foreign students learn international skills during study in NZ, the viability of a programme increases. However, modification of the curriculum to attract foreign students can run counter to a desire to prepare Masters students for NZ-specific registration
  - Cost can be reduced if a Masters programme can be run without expensive laboratory, project, or field learning experiences. However, practitioner-led degrees may expect many of these types of learning experiences

Current Situation & Potential Solution

- No university is likely to be willing to invest in new academic staff, teaching spaces, etc., on the hope that a viable programme will result
- The end result is that no one NZ tertiary institution seems willing to run a Masters of Environmental Engineering
- By combining the existing strengths at individual universities with expertise in research-only organisations and among specialist experts, there would seem to be **potential** for one nation-wide degree

Today's Workshop Participation

- Split into four groups: answer questions a) to d)
- Report back and discuss
- Split into four groups: answer questions e) to h)
- Report back and discuss

Which Way for Environmental Engineering?

a) ***Should NZ look to develop a specialist environmental engineering registration process in the medium-term (5-15 years)?***

- likely require a registration-equivalent Body-of-Knowledge and a Masters degree to most efficiently prepare students for future registration
- environmental engineering could be viewed as too broad and diffuse for a highly specified approach
- if environmental engineering is too broad and diffuse to be codified, the public may not afford as much value to a vaguely defined and tested specialisation

Which Way for Environmental Engineering?

b) Should some narrower specialisation be a focus of a specialist registration process? E.g., Is there sufficient demand for a public health engineering registration?

- The Havelock North inquiry has highlighted how a lack of accountability can contribute to failures of drinking water systems.
- The IPENZ 2017 submission to Stage 2 of the inquiry notes that "… engineering graduates coming through tertiary institutions today lack sufficient background and core knowledge in public health engineering ... to effectively prepare them…"

Which Way for Environmental Engineering?

c) Are practitioners willing to get involved to control a practitioner-driven degree (whether for Env. Eng. or Public Health Eng. or anything similar)?

- Other specialist engineering groups appear strongly motivated to advance matters
- If that same motivation does not exist within the broader set of environmental engineering practitioners, then now may not be the time to advance plans

Which Way for Environmental Engineering?

d) Would employers value the extra education and preferentially hire/pay Masters graduates? Under what conditions?

Today’s Workshop Participation

- Split into four groups: answer questions a) to d)
- Report back and discuss

Further Participation

Now address questions e) to h)

Which Way for Environmental Engineering?

e) What should be taught?

- If the degree is nationwide, the need for some agreement about scope becomes critically important
- The question of what should be taught is closely tied with the question of what preparation students should be expected to have

Which Way for Environmental Engineering?

f) How should it be taught?

- Traditional lecture-based educational methods are slowly becoming less effective and some institutions are moving more towards on-line instruction at the masters level
- On-line instruction can only be effective when combined with active learning and reflection (e.g., laboratory work, field work, project-based learning, site visits, case studies, research project work)
- Work placements are increasingly used as part of an overall engineering education programme
- More active learning can imply more involvement of practitioners in education, which might require new teaching skills by practitioners

Which Way for Environmental Engineering?

g) What preparation should any future degree target or avoid for its intake of students?

- Design of a viable programme requires assessment of the likely incoming students as well as looking at the desired endpoint
- Foreign students will have different educational needs than domestic ones (e.g. a need for technical English writing or study of NZ legislation)
- Students with a chemical engineering background will differ from those with a civil engineering background
- Students without engineering backgrounds (for example, in environmental science) could need particular attention in terms of supplemental courses
- If any programme is to be part of a pathway to a specialised registration, the restrictions on incoming students could be greater

Which Way for Environmental Engineering?

h) What institutional model would work for an inter-university degree?

- How to surmount competition? Universities are averse to attracting students and their fees, and then sending funds to another university for teaching services
- How to ensure quality? Each institution is reluctant to let another institution decide whether they are meeting the needs for an inter-institutional effort

Workshop Findings

Report back

Next Steps

- Form a working group to explore specific matters further?
- The group could explore the intersection of what's needed and what's practical and report back to various stakeholders
- How to involve those not here today?