Capacity Building for sustainable development through the International Engineering Alliance Accords

Em Prof Elizabeth Taylor AO
Deputy Chair Washington Accord
Chair Accreditation Board Engineers Australia
Sustainable Development

A fragile environment
An interdependent world
An aspiration to leave no one behind

Engineering Capacity Building

The International Engineering Alliance Accords
Establishing a global engineering education standard that drives sustainability
Facilitating engineering mobility – creating networks, sharing ideas
Building engineering capacity for sustainable development

Working together to create a shared and better future
Engineering appears to be on the cusp of a new golden age.

The physical, digital and biological are blurring.

A melting pot of technologies and cyber-physical systems offer great potential and challenge.
As with each Industrial Revolution, the benefits of this Fourth Industrial Revolution are being extolled:

- Big data analytics capacity
- Data encryption depth
- Modelling power – climate, economic, biological systems

Within engineering circles discussion of the challenges generally revolve around accommodating emerging technologies:

- Applied anthropomorphism in AI evolution
- Cyber Security and Privacy
- Genetic engineering/modification/manipulation
Engineering is the art of directing the great sources of power in nature for the use and convenience of man.

Thomas Tredgold 1828
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The story of plastic
We are the priests of material development, of the work which enables other men to enjoy the fruits of the great sources of power in Nature, and of the power of mind over matter. We are the priests of the new epoch – without superstitions.

George Morison, 1895
ASCE Presidential Address,
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CAST International Forum on Engineering Capacity
November 2018
The more engineers create, the more they are required to create to control the ever emerging negatives that arise from their original actions.
The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all.

They address the global challenges we face:

- poverty,
- inequality,
- climate,
- environmental degradation,
- prosperity, and
- peace and justice.
The Goals interconnect and in order to leave no one behind, it is important that we achieve each Goal and target by 2030.
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Robert Goodland & Herman Daly
Environment Department
World Bank 1991
Achieving Sustainable Development will require very different engineering capability to that which has underpinned progress to date.

Building engineering capability for sustainable development will require:

rethinking engineering capability

innovative educational models
The capacity of engineers to deal with complexity, environmental fragility and global interdependence will be crucial in determining what future we have.
Accords:

Establishing a global engineering education standard that drives sustainability
2015 IEA/ENAEE publication: “Best practice in Accreditation”

Federation of Engineering Institutions in Asia and the Pacific (FEIAP) has developed an accreditation development pathway that facilitates IEA Accord signatory status.

World Federation of Engineering Organisations (WFEO), in partnership with IEA, established a project in June 2018 to address the needs of its members in the developing world, based on IEA standards.
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### Capacity Building for sustainable development through the International Engineering Alliance Accords

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**Washington Accord programme** provides:

**WK1:** A systematic, theory-based understanding of the **natural sciences** applicable to the discipline

**WK2:** Conceptually-based **mathematics**, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline

**WK3:** A **systematic**, theory-based formulation of **engineering fundamentals** required in the engineering discipline

**WK4:** Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

**WK5:** Knowledge that supports **engineering design** in a practice area

**WK6:** Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline

**WK7:** **Comprehension of** the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability

**WK8:** Engagement with selected knowledge in the **research literature** of the discipline

A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry.
Accords:
Facilitating engineering mobility – creating networks, sharing ideas

MUTUAL RECOGNITION OF SUBSTANTIAL EQUIVALENCE

“The signatories have exchanged information on, and have examined, their respective processes, policies and procedures for granting accreditation to engineering academic programs and have concluded that these are comparable.

“Through the Washington Accord…. The signatories recognise the substantial equivalence of such programmes in satisfying the academic requirements for the practice of engineering at the professional level.”

p4 Accord Rules and Procedures 13 June 2014

The Accords validate jurisdictional accreditation systems, embedding the diversity arising from cultural and jurisdictional imperatives.
The Accords then are a living compact made by each signatory that they will approach deliberations with **confidence**:

✧ we can gain insight from our different cultural, socio-political and legal environments.

✧ we can find common ground and build a strong network from our collective understanding.

✧ we can negotiate, learn and transform in good faith as we create the terms of our engagement.
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International Engineering Alliance Meetings

Provisional and full members

Exemplar standard Graduate Attributes

Peer review by 3 signatory members

Quality assurance confirmation that articulated standards achieved and processes followed

Jurisdictional Accreditation Organisation

The Profession

Educational providers

Jurisdictional Competency standards/attributes

Note: Simplified diagram indicative only
It is hard work

It requires continuous maintenance and nurturing and close interaction

It can be easy to slip into actions derived from unintended, subtle claims about ‘our way’ superiority

To misunderstand across our language nuances in our haste to make things happen

To deploy ‘short-cut’ metrics, pro-formas, standards and other tools that draw us away from the uncertainty and energy of continuous relationship building and close interaction
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There are a number of reasons why mutual recognition of substantial equivalence, although a hard route, adds significant value to accreditation and enhances international practice.

Sociological, anthropological and ecosystem studies suggest that diversity in our systems drives innovation and capacity to meet complexity, disruption and change.

Whenever a system is captured by one culture, by one world view, or one intellectual tradition and iterates to one metric (standard) of success, its capacity for intellectual flexibility and agility is significantly reduced.
The challenge for the Accords is to

✧ consciously choose the power of mutual recognition and the embedded diversity in our organisational DNA

✧ ensure that quality assurance tools are chosen carefully to enhance, rather than undermine, this DNA diversity.
The story of the Snowy Mountains Irrigation System Australia built during the 1950s
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Salt of the earth
Addressing the growing problem of salinity

When the rivers run dry….
Whose water?
What use?

50 years on………..

Institution of Engineers
National Salinity Prize
$30,000 Prize for innovation in dealing with salinity

China: Dujiangyan Irrigation System built 256 BC

http://history.cultural-china.com/en/54History2795.html
### Accords:

**Building engineering capacity for sustainable development**

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- Participatory Design
  - Extraction and Processing of Raw Materials
  - Conservation Economics
    - Precautionary Principle
  - Industrial Ecology
    - Life Cycle Inventory
- Eco-balancing
  - Recycling and Disposal as waste at the end of its useful life
  - Material Flow Analysis
    - Use, reuse and maintenance of the Product
    - Packaging
  - Life Cycle Analysis
    - Marketing
- Cradle to Grave Analysis
What will be the story of quantum computing?

THREE WAYS TO MAKE A SILICON QUBIT

1. Simmons’ group builds the P-atom into the silicon crystal.
2. Morello and Dzurak fire phosphorous atoms into the silicon crystal.
3. Dzurak’s group tweaks silicon transistors to produce quantum dots.

Credit: Cosmos Magazine UNSW
Working together to create a shared and better future
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November 2018
The Earth Charter

We stand at a critical moment in Earth’s history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny.

http://earthcharter.org/discover/the-earth-charter/
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