UNESCO- WFEO – IEA Projects
Transforming the international benchmark for engineering education, capacity building and training

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WFEO President 2017-2019

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www.wfeo.org
The World Federation of Engineering Organizations (WFEO):

• The leading international body for professional engineering institutions
• Founded in 1968, under the auspices of UNESCO
• 100+ national professional engineering institutions, 12 international and continental/regional professional engineering institutions, representing 30 million engineers
• Co-Chair - Major Science and Technology Group at UN
• Represent engineering at major UN Organisations
WFEO – UNESCO
Declaration, signed on March 7, 2018

Paris Declaration
Advancing the United Nations Sustainable Development Goals through Engineering

The World Federation of Engineering Organizations (WFEO) is the main body for engineering globally, representing nearly 100 nations and some 30 million engineers.

The members of WFEO are the national and regional professional engineering institutions of the world. WFEO is a member of the United Nations Scientific and Technological Community (UN STC) Major Group and has an official Associate status with UNESCO.

UNESCO, as the United Nations agency for education, science and culture, supports engineering through its Natural Sciences Sector, and acknowledges engineering as a powerful means to achieve sustainable development, capacity-building in engineering education and gender equality in developing countries, as well as the safeguarding of world heritage.
Increase the number and quality of engineering graduates...

Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards...

Support Capacity Building through strong institutions for engineering education...

Accordingly, we declare:

1. WFEO, a recognized member of the UN STC Major Group and UNESCO, through its Natural Sciences Sector, will work together and in cooperation with other UN organizations, including UNEP, UNFCCC and UNISDR towards achieving the SDGs through engineering.

2. WFEO and UNESCO are committed to the following principles for action through engineering to achieve the SDGs:
   a. Increase the numbers and quality of engineering graduates that meet the needs of sustainable development with rapidly changing technologies, in collaboration with educators, government and industry;
   b. Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards and facilitate the mobility of engineers;
   c. Support capacity-building through strong institutions for engineering education and the development of accreditation bodies for the recognition of professional credentials;
   d. Establish policy frameworks and best practices, notably through WFEO Standing Technical Committees, as digital technologies, data sciences and artificial intelligence have ethical and social implications.

Signed in Paris, 7 March 2018

Marlene Kanga
President
World Federation of Engineering Organizations

a.i. Flavia Schlegel
Assistant Director-General for Natural Sciences
UNESCO

Note: “standards” used in 2018, Since 2019, using “benchmarks” to align with IEA definitions
UNESCO WFEO IEA Plenary on Engineering Education @ WEC2019, Melbourne Nov. 2019, Declaration and committing to working together

1. **Recognise the Current IEA Graduate Attributes and Professional Competencies Framework** as international engineering benchmark standards;

2. **Support IEA review of the IEA Graduate Attributes and Professional Competencies** to ensure that they meet the requirements for new technologies and engineering disciplines, new pedagogies and include contemporary values such as sustainable development, diversity and inclusion and ethics;

3. **Extend the global reach of the IEA Agreements and Accords** through capacity building efforts, such as mentoring and training, that support the development of engineering accreditation and professional competence/registration/licensure systems, appropriate to each jurisdiction;

4. **Support the development of professional engineering institutions** through capacity building efforts to ensure engineering quality and standards are maintained;

5. **Support the development of national, regional and international registers** and liaise with governments for the regulation of engineers to ensure their competence, performance, integrity and accountability throughout their careers, and

6. **Facilitate the international mobility of engineers.**
UNESCO WFEO IEA Plenary on Engineering Education @ WEC2019 – Declaration committing to working together

Signing of MoU between IEA and WFEO, WEC2019, Melbourne

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The International Engineering Alliance (IEA) and the benchmark Framework for Graduate Attributes and Professional Competencies (GAPC)

- **IEA is an umbrella organisation** that provides governance for the three Accords and four Agreements that provide international multilateral recognition of graduate attributes and professional competencies across 30 countries.

- For graduation after tertiary engineering education course:
  - Washington Accord – Professional Engineer 4-5 years
  - Sydney Accord – Engineering Technologist – 3-4 years
  - Dublin Accord – Engineering Technician -2 years

- After graduation for professional registration:
  - Intl. Professional Engr. Agreement – Prof. Engineer 4-5 years
  - Intl. Technologist Engr. Agreement – Eng. Technologist – 3-4 years
  - Intl. Associate Engr. Agreement – Eng. Technician -2 years
  - APEC Engineering Agreement – APEC Region- Prof. Engineer 4-5 years
Engineering 2030 – Principles for Action

1. Encourage young people – To consider engineering as a career
2. Graduate Outcomes - Agree with educators, government, industry
3. Global standards - for engineering education and professional development
4. Partnerships – with international standard setting organisations for consistent international framework
5. Support – development of national engineering education systems to comply with agreed standards
6. Capacity Building – for accreditation of engineering education and accreditation bodies
7. Capacity Building – for professional engineering institutions
8. Develop professional competency pathways – so graduates meet employer needs
9. Support national and international registration – for recognition of qualifications and experienced of practising engineers
10. Liaise with governments – to establish consistent regulation policies for engineers
11. Establish an international platform for engineering standards – Education and professional development, under auspices of WFEO and UNESCO
12. Report on progress - to UNESCO and other international organisations

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These projects:

1. Engineering education for the right skills - Goal 4
2. Develop institutional capacity – Goal 16 accreditation bodies and professional engineering institutions
The second UNESCO Engineering Report – “Engineering for the SDGs”, Chapter 1, author Dr Marlene Kanga recommends:

1. “Government, engineering educators, industry and professional engineering institutions need to collaborate to increase the number and quality of engineers.

2. There is also a need to work in partnership to develop the necessary international engineering education benchmarks for sustainable development.

3. These need to be recognised across the world and form the basis of national engineering education systems for engineers with the right skills especially Asia, Africa and Latin America.”
UNESCO is a key partner for the review of engineering benchmarks for Graduate Attributes and Professional Competencies (GAPC)

Recognition by UNESCO ensures that the IEA GAPC is the pre-eminent international benchmark for engineering education.
WFEO IEA Working Group #1 – Review of Graduate Attributes and Professional Competencies (GAPC) – the international benchmark for engineering education across more than 30 nations in every continent
The Review of International Engineering Alliance (IEA) and the benchmark Framework for Graduate Attributes and Professional Competencies (GAPC)

• Joint Working Group with members from both WFEO and IEA established in November 2019 to review the benchmarks:
  • Representatives of IEA Signatories
  • Representatives of WFEO Members
  • Work Commenced Nov 2019 – Completed and approved by IEA signatories June 2021
Transforming the international benchmark for engineering education in partnership with the International Engineering Alliance (IEA) and World Federation of Engineering Organisations (WFEO)

Objective of Review of Global benchmark - for engineering graduates outcomes – to reflect changes in societal needs and contemporary values including:

- Impact of engineering work on the UN Sustainable Development Goals
- Diversity and Inclusion in engineering teams
- Emerging technologies and disciplines in engineering
- Rapidly changing technology environment and learning systems
- Ethics
- Commitment to Lifelong learning
- Development of skills for critical thinking, innovation, assessment of outcomes
International Engineering Alliance

Graduate Attributes & Professional Competencies

Proudly supported by:

GAPC Translations into six official UNESCO languages: EN FR SP RU CN AR completed Jan 2022. Awaiting approval by IEA and publication.
The decision by IEA signatories to approve the reviewed GAPC Framework is of great importance to engineers and to the world.

The implementation of this Framework will result in a transformation of the engineering profession, with graduates who are critical thinkers, thoughtful about the impact and outcomes of their work, capable of working in diverse and inclusive teams and are committed to lifelong learning.

It will strengthen the achievement of the aspirations in the preamble of the GAPC:

“Engineering therefore must be carried out responsibly and ethically, use available resources efficiently, be economic, safeguard health and safety, be environmentally sound and sustainable and generally manage risks throughout the entire lifecycle of a system. The United Nations Sustainable Development Goals present targets for 2030. Engineers are vital contributors for making progress towards these goals.”
WFEO IEA Working Group WG2: Capacity Building in Engineering Education
Capacity Building in Engineering Education

Meeting of UNESCO WFEO IEA Working Group 2, WFEO and IEA Representatives from Australia, Hong Kong, Turkey, South Africa, Myanmar, 22 March 2022

- Joint Working Group with members from both WFEO and IEA established in November 2019 to review the benchmarks:
  - Representatives of IEA Signatories
  - Representatives of WFEO Members
The need for more engineers with the right skills - Comparison of numbers of engineers – South Africa, USA, UK

The engineering numbers

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NUMBER</th>
<th>TOTAL IN THE WORKFORCE</th>
<th>REGISTERED</th>
<th>% REGISTERED</th>
<th>GRADUATES</th>
<th>% FEMALE</th>
<th>GRADUATES AS A % OF THE WORKFORCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers</td>
<td>114 579</td>
<td>34 722</td>
<td>30%</td>
<td></td>
<td>9 875</td>
<td>22.0%</td>
<td>9%</td>
</tr>
<tr>
<td>Technologists and technicians**</td>
<td>114 281</td>
<td>12 746</td>
<td>11%</td>
<td></td>
<td>15 607</td>
<td>24.7%</td>
<td>14%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>228 860</td>
<td>47 468</td>
<td>21%</td>
<td></td>
<td>25 482</td>
<td>23.7%</td>
<td>11%</td>
</tr>
</tbody>
</table>

* Totals are understated as graduation data from some countries is incomplete – see Figure 23
** Technologist and technician categories are not recognised in all countries – see Table 24

- 68 engineering practitioners per 100,000 population in SADC – ranging from 531 to 18
- 850 engineering practitioners per 100,000 population in the USA
- 1 160 engineering practitioners per 100,000 population in the UK

Reach of Current Mutual Recognition Systems

Source: https://www.engc.org.uk/international-activity/international-relationships-map/

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WFEO and IEA: Proposals for Action – Capacity Building

1. Capacity Building – development of national engineering education systems to comply with agreed benchmarks
   1. Training for mentoring and support for development of education assessment systems and accreditation of programs
   2. Training for educators – complementary programs by partners e.g. IFEES
   3. Support for Higher Education Institutions to develop their infrastructure, facilities and systems to achieve the desired graduate attributes from outcomes based education

2. Capacity Building – Build institutional capacity for accreditation bodies and professional engineering institutions
   1. Governance for accreditation bodies and PEIs
   2. Support development of regulatory framework for engineering appropriate to the country’s national systems and priorities
   3. Training and development for leadership, governance and systems
      1. Training in and Assessments in country
      2. Supported and facilitated by WFEO national and international members

Engineering for Sustainable Development

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Washington Accord approved mentoring support, Jun. 2022:

• **Institution of Engineers Mauritius (IEM)** mentored by India (NBA – National Board of Accreditation) and South Africa (ECSA Engineering Council of South Africa)

• **Engineers Board of Kenya (EBK)** mentored by Pakistan (PEC- Pakistan Engineering Council) and Malaysia, (BEM - Board of Engineers Malaysia)

• **Ghana Tertiary Education Commission (GTEC)**, mentored by China (CAST – China Association of Science and Technology) and Sri Lanka (Institution of Engineers Sri Lanka)

• Monthly mentoring meetings and significant progress made. Plans for provisional signatory status applications from 2023 onwards.

• Hub and spoke model to expand support in three regions of Africa: South, East and West
WG 3: Capacity Building for Engineering Education Systems – Training at Scale
WFEO Academy website

The World Federation of Engineering Organisations is the peak body of professional engineering institutions internationally with some 100 national, regional and international engineering institutions as members and partners representing more than 30 million engineers.

Ready to get Started?

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WG3: Engineering Education Training

• Partnership with
  • International Engineering Alliance (IEA)
  • International Federation of Engineering Education Societies (IFEES)
  • Global Engineering Deans Council (GEDC)
  • WFEO Members and IEA Signatories

• Sharing of content of webinars already presented - Structured training for:
  • Accreditation bodies
  • Professional engineering institutions
  • Engineering educators
  • Engineers, technologists and technicians – non-discipline specific training, career development

• Establish recognition of training
  - National and international registers
  - Facilitates mobility for engineers, technologists and technicians
WFEO Academy website: Open Science in Action

The WFEO Academy uses UNESCO Open Science principles to provide vital training at no cost, to all.

The website uses innovation and advanced technology to make content available inclusively to all. Individuals will be encouraged to register and take up the courses and will be issued with certificates of completion with additional bronze, silver and gold awards to encourage the uptake of multiple courses.

Courses are available in nearly 100 languages and scripts, it can be accessed by all, men and women wherever they are, and ensuring that no one is left behind.

The training benefits are expected to have long term impact on the economies that are supported and thus support the mandate of both WFEO and UNESCO in building capacity for engineering education and professional development of engineers.
WFEO Academy website - Courses

• The course materials draw on the existing webinar resources of the members, affiliates and partners of WFEO
• These webinars thus gain a wider audience and greater utilization.
• This is a sustainable approach, using the knowledge and goodwill of hundreds of experts that have given their time willingly for the webinars and will build knowledge and skills.
إعادة تحديد المعايير لخريجي الهندسة

by Marlene Kanga 2022
WFEO Academy website – Maximising access with translation - Hindi
WFEO Academy website – Maximising access with translation - Swahili

IFEES // Kuweka upya Vigezo kwa Wahitimu wa Uhandisi wenye Ustadi Sahihi kwa Maendeleo Endelevu

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WFEO Academy website –
Maximising access with translation - Myanmar

IEES // အျပည်ဆောင်မှုများ ပြုလုပ်
စီမံခန့်ခွဲ ရှာဖွေနေသူများကို ထိန်းချုပ်နိုင်မှုများအား
ပေးပျီး အရေးပါသော မှန်မှန်အချက်များကို နေရာများစွာ ထောင်စုပေးသော
ဖော်
WFEO Academy: UNESCO Support

UNESCO Natural Sciences Sector Capacity Building Division, is a key supporter of this project and will engage its member states in promoting it. This project activities the UNESCO Open Science Recommendations and uses innovation and technology to transfer much needed skills to developing countries in Asia, Africa and Latin America. The benefits of this project are global and will continue to have far reaching impacts.
Engineering for Sustainable Development

- Participation
- Influence
- Representation
The world’s engineers united in rising to the world’s challenges. For a better, sustainable world.