Engineering skills where they are Most Needed Programme

# Call for Ideas Result Analysis
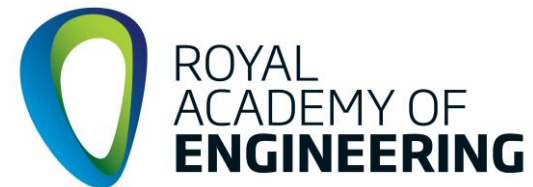
Call for Ideas Survey

- The Engineering Skills Where they are Most Needed Programme conducted an online survey, The Call for Ideas, to allow the community to identify the critical engineering and educational challenges.

- The programme aims to support ambitious and innovative projects and partnerships that builds engineering skills where it is most needed to safely operate and maintain critical engineering infrastructures with a focus on the emerging technologies, which will enable us to make the most impact,

- The result of the survey will help us to design suitable funding schemes to address the critical challenges identified

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Participating Countries

143 Respondents from 29 Countries, 5 Continents

Geographical Regions of Survey Participants
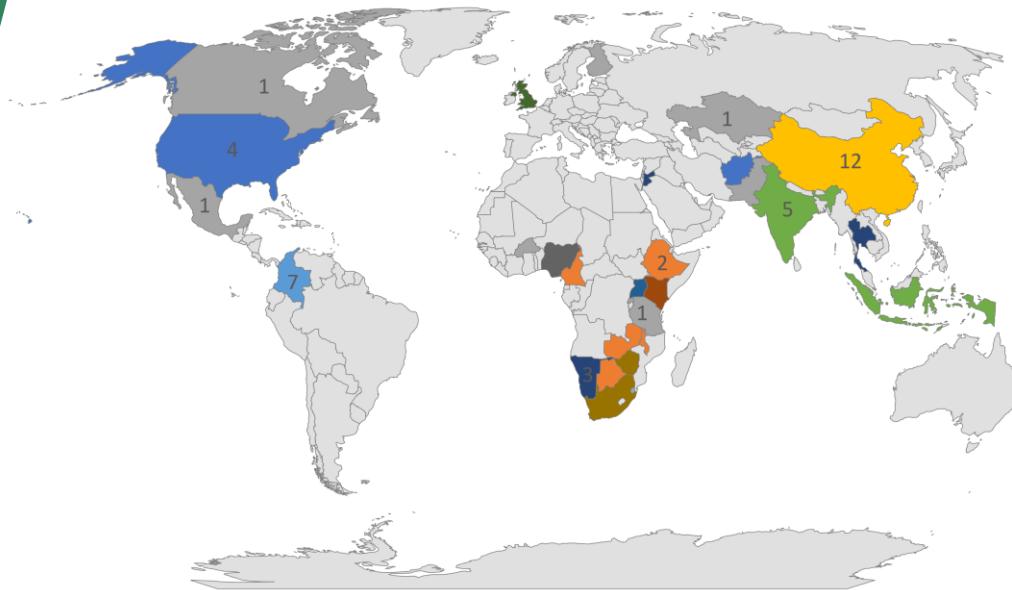
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Responses/Country


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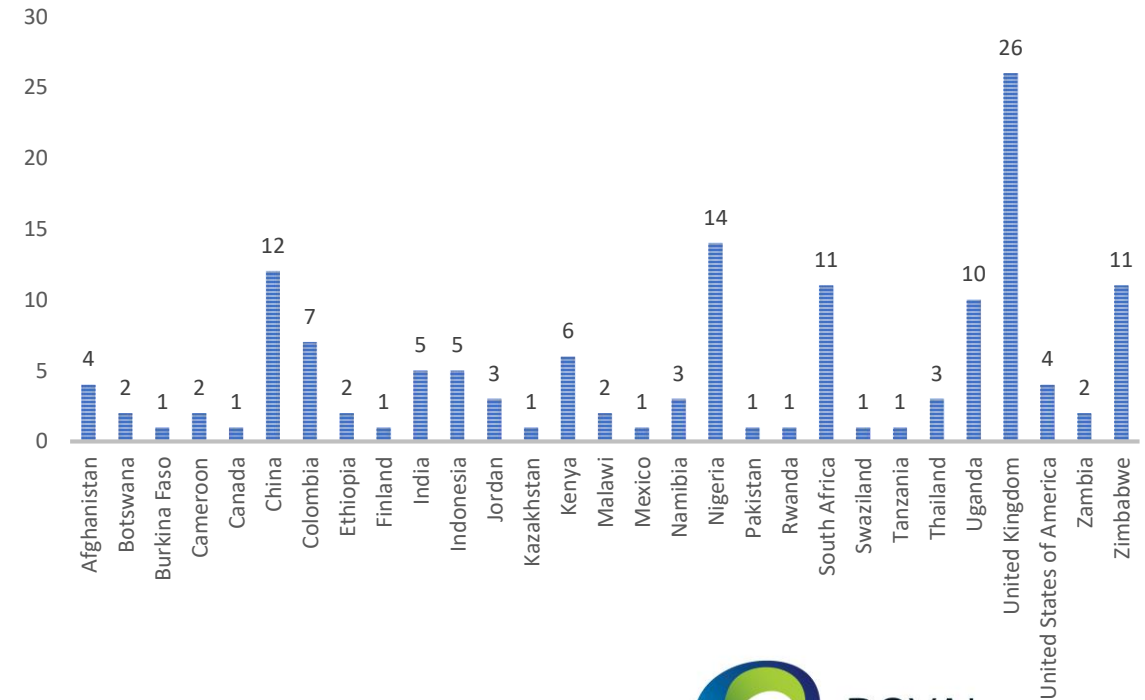
Question 1

What are the three most critical engineering challenges faced in your country or region that can be addressed through this programme? Please include references and data where available. If you need assistance you may wish to use the Engineering Index report.

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Cross-sector Engineering Skills

## Critical Cross-sector Engineering Skills Most Needed
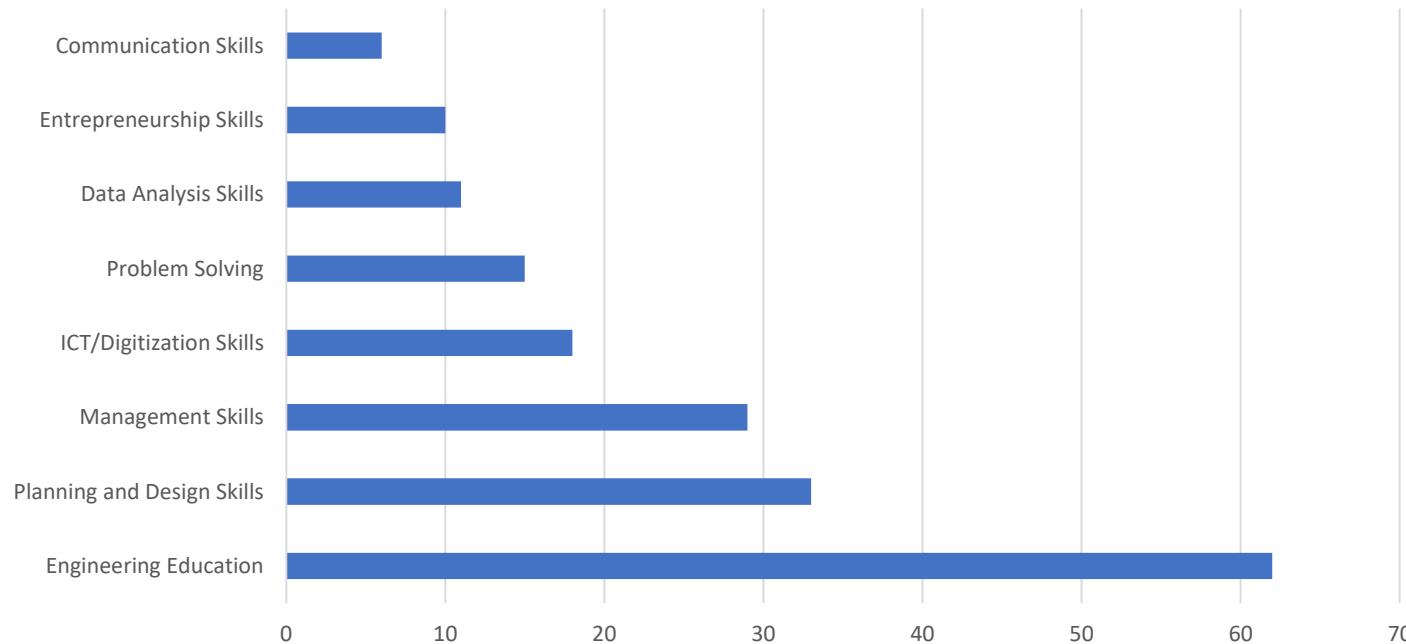
Analysis: After a thorough analysis of the responses received; the Engineering skills most needed challenges grouped in 8 cross-sector engineering skills as presented in the graph. The participants prioritised Engineering Education skills as the top critical challenge – this includes engineering pedagogy, teaching skills, and teaching resources using technology. The planning and designing skills across all the engineering sectors that include designing roads & bridges, water supply systems, and buildings have been prioritised second. Management skills such as managing mega projects, contracts, and maintenance of infrastructures were prioritised as the third critical challenge.

Project Proposals Topics: We will consider project proposals addressing any of the cross-sector engineering skills most needed challenges. Therefore, you can pick the topic for your project proposal from this analysis as shown in graph. However, considering the funds availability, we will consider project proposals that addresses one of the top three challenges.

Note: The critical challenges have been grouped by Engineering **Skills Most Needed,** Policy and Approaches, and Engineering Sectors.

Policy Area And Approaches

Critical Engineering Challenges by Policy Area and Approaches
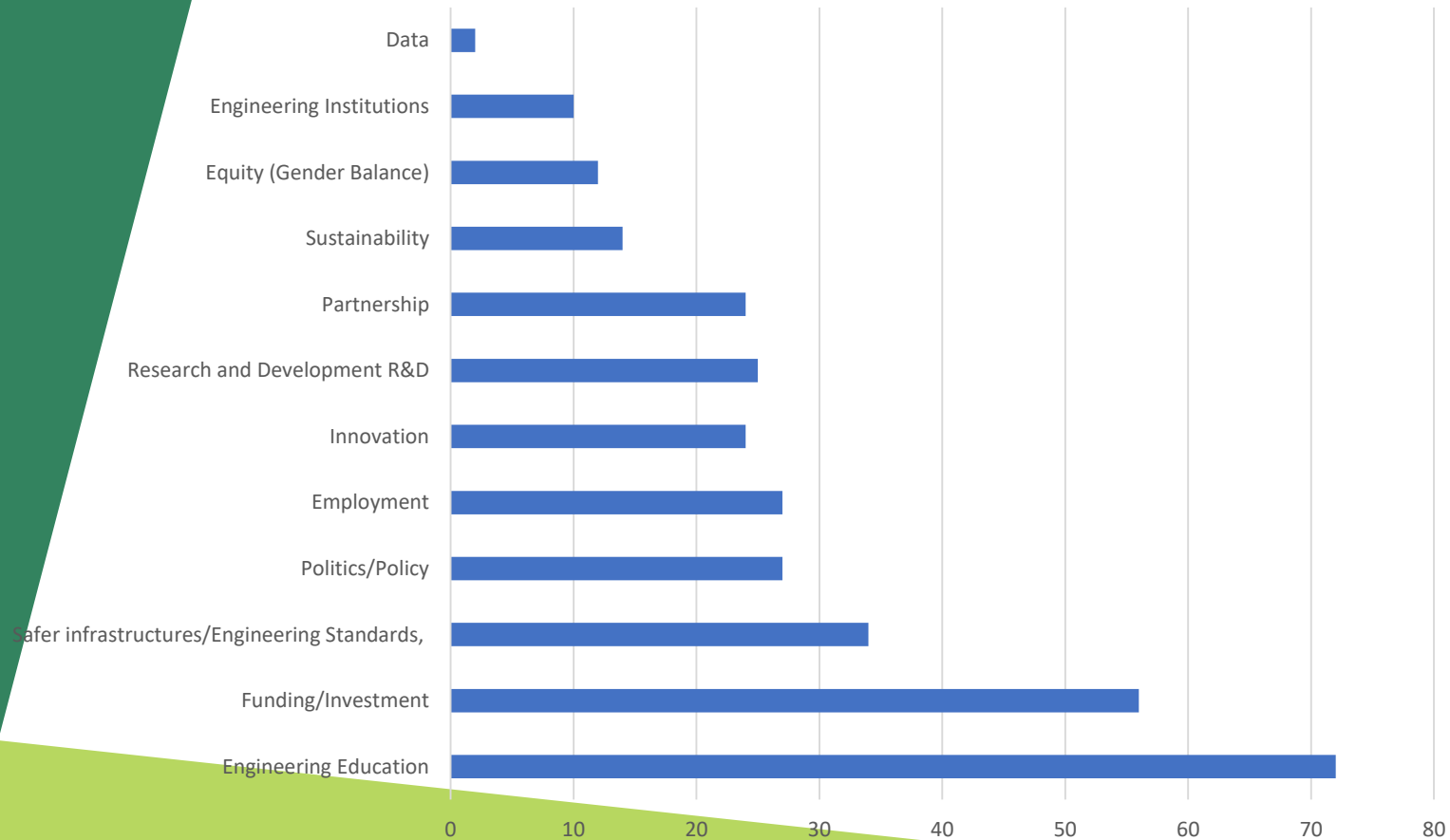
Analysis: After a thorough analysis of the responses received; the strategic and regulatory issues grouped in 12 areas of Engineering Policy and Approaches as presented in the graph. The participants once again prioritised Engineering Education as the top critical challenge – this includes shortage of skilled educator and graduates, and courses content that addresses current and future demand, and accreditation of degrees by international universities. The shortage of funding and investment for developing engineering infrastructures such as water supply schemes, waste recycling, and digital infrastructures prioritised as the second critical challenge. Safety of infrastructures throughout life of infrastructures (design, construction, utilisation, maintenance, re-use and recycling) through use and application of better engineering standards and practices prioritised as the third critical challenge that engineers are experiencing.

Project Proposals: We will consider project proposals addressing any of critical challenges that has been identified in this survey. Therefore, you can pick the topic for your project proposal from this analysis as shown in graph. However, considering the funds availability, we will consider project proposals that addresses one of the top three critical challenges.

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Note: The critical challenges have been grouped by Engineering Skills Most Needed, **Policy and Approaches**, and Engineering Sectors.

Engineering Sector

Critical Challenges by Engineering Sector

Chart: Critical Challenges by Engineering Sector (horizontal bar chart, x-axis 0 to 35)

- Aerospace and Aeronautical Engineering: 1
- Chemical Engineering: 4
- Materials Engineering: 5
- Mechanical Engineering: 5
- Electric and Electronics: 8
- Waste Management: 10
- Production and Manufacturing Engineering: 12
- Civil and Structural Engineering: 20
- General Engineering: 22
- Energy Engineering: 23
- Environmental Engineering: 31
- Software and Computing Engineering/Technology: 33

Analysis: After a thorough analysis of the responses received; the critical engineering challenges are classified under 12 Engineering sectors as presented in the graph. It worth mentioning that this classification is in line with the engineering sectors proposed by tomorrow's engineers. The participants prioritised Software and computing Engineering as the top priority – this includes use of recent technology and automation of engineering infrastructures across all engineering sectors. Environmental Engineering that includes air pollution such as CO_2 and nitrogen oxide emissions, global warming, ecology, waste disposal and recycling has been prioritised the second critical challenge. Energy engineering that includes oil and gas, nuclear power and renewable energy (such as biofuels, wind, hydro and solar energy, has been prioritised as the third critical challenge that engineers in the low income and developing countries are experiencing.

Project Proposals: We will consider proposals addressing a need in any of the prioritised engineering sectors for example: use of latest technology in engineering infrastructures, automation, digitisation, air pollution control, and transportation and etc. However, considering the funds availability, we will consider project proposals that addresses one of the top three critical challenges.

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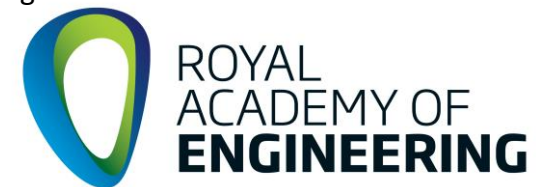
Note: The critical challenges have been grouped by Engineering Skills Most Needed, Policy and Approaches, and **Engineering Sectors.**

Question 2

What needs to change within the education system in your country in order to equip people with the necessary skills to address these critical engineering challenges, related to any or all of the three below educational segments?

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Education System Critical Challenges

Universities

Diversity
Management/Leadership
Accreditation of Engineering Degrees
Pedagogical Skills (Teacher training)
Career guidance/Employment
Critical Thinking/Analytical/Problem solving…
Qualified/Quality Teaching
Digital technology/Artificial intelligence
Research and Development/Innovation
Funding/Facilities/infrastructures
Partnership
Curriculum/practical

0   20   40   60   80   100

Schools

Diversity
Pedagogical Skills (Teacher training
Partnership between schools and universities
Career guidance
Digital technology/Artificial intelligence
Facilities/infrastructures
Qualified/Quality Teaching
Innovation mindset
Critical Thinking/Analytical/Problem solving
Promote engineering knowledge at…
STEM Education
Curriculum/practical

0   5   10   15   20   25   30   35   40   45   50

Analysis: After a thorough analysis of the responses received; universities critical challenges have been classified in 12 challenges as presented in the graph. Engineering universities curriculum that includes practical and technology have been prioritised as the first challenge. Partnership and collaboration between universities and industry has been ranked the second challenge. Scarcity of funding for equipment and developing technology-based infrastructures prioritised third in the list.
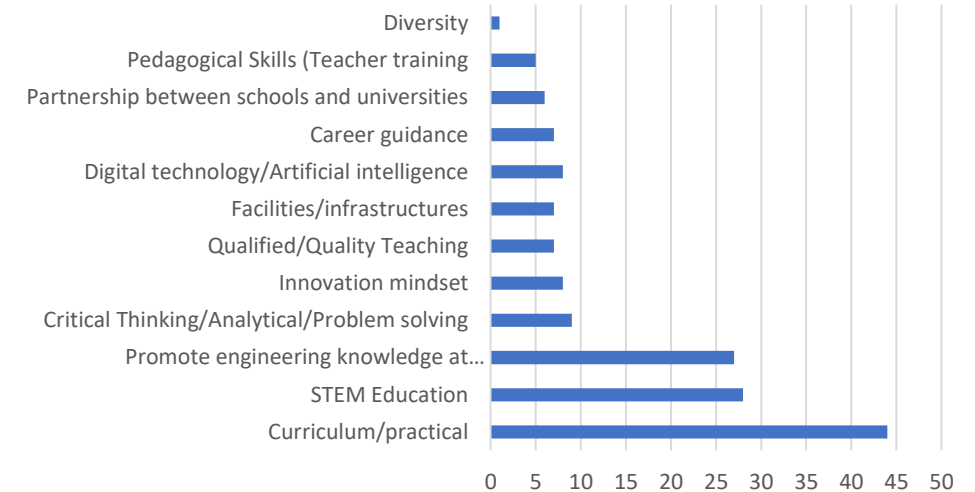
Analysis: After a thorough analysis of the responses received; schools critical challenges have also been classified in 12 challenges as presented in the graph. Again, the absence of an up to date curriculum that includes practical and technology has been priorities as the first challenge. Focus on STEM education at schools has been prioritised second. And promotion of engineering knowledge in schools has been ranked as the third challenge.

Project Proposals: We will consider project proposals addressing a need in any of the prioritised critical challenges outlined in the above three graphs. However, considering the funds availability, we will consider project proposals that addresses one of the top three critical challenges.
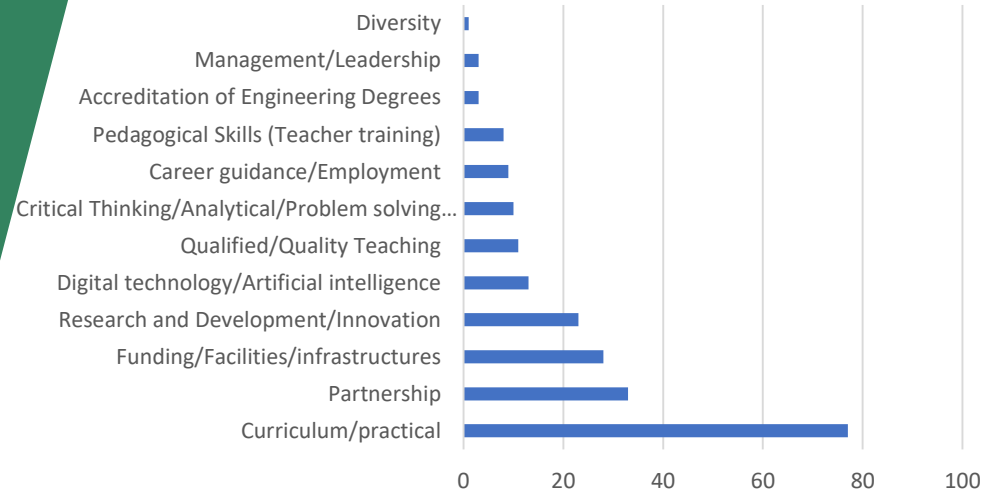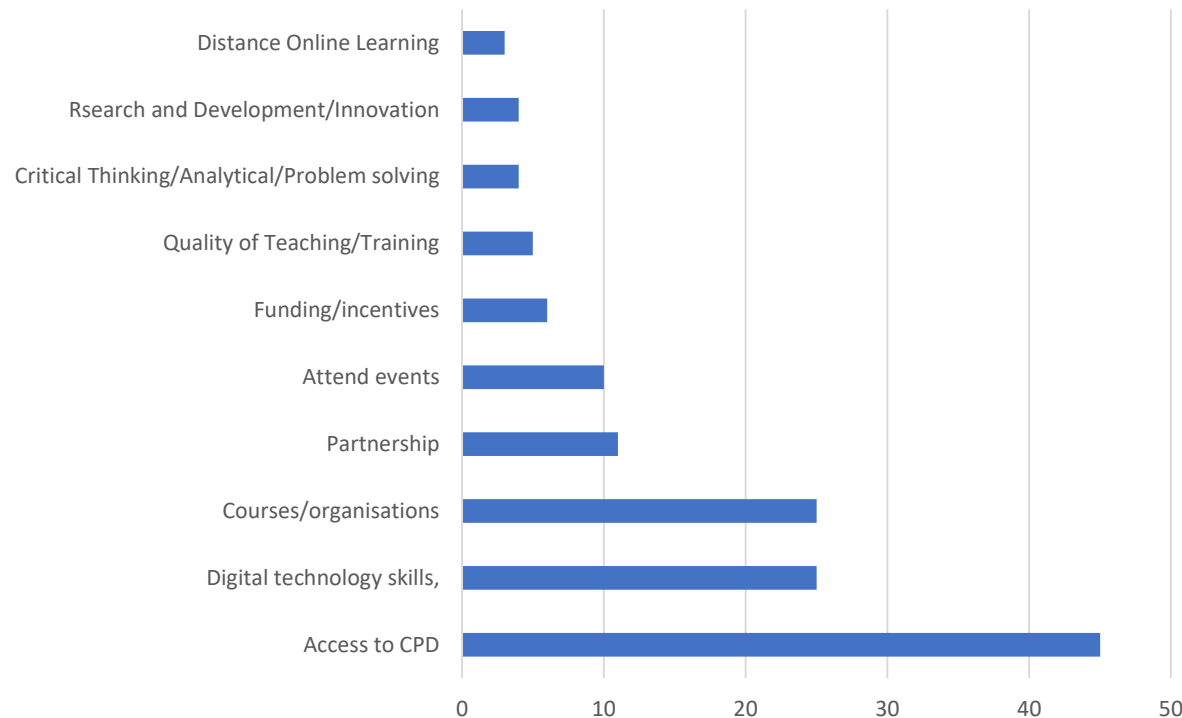
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Education System Critical Challenges

Adult Education and CPD

Analysis: After a thorough analysis of the responses received; adult education and CPD challenges were classified in 10 challenges as presented in the graph. The participants considered adult education and CPD very important throughout life of a professional and therefore they prioritised access to CPD as the first challenge for Engineers considering the rapid changes in technology. Therefore, they prioritised digital technology skills as the second challenge. Offering the right courses and CPD institutions has been ranked as the third challenge.
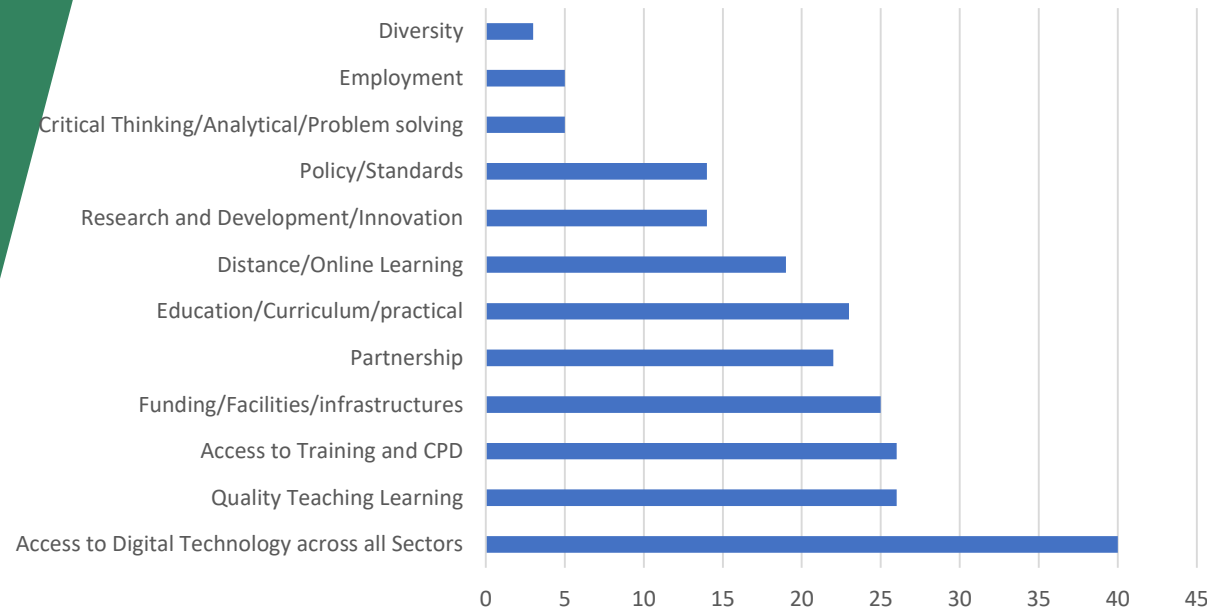
Project Proposals: We will consider project proposals addressing a need in any of the prioritised critical challenges outlined in the above three graphs. However, considering the funds availability, we will consider project proposals that addresses one of the top three critical challenges.

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Question 3

How can we best leverage disruptive emerging and digital technologies in tackling these challenges and what opportunities do disruptive technologies bring for improving education systems?

Leverage Disruptive Technologies

Leverage Disruptive Technology in Addressing the Critical Challenges

Bar chart categories (top to bottom):
- Diversity
- Employment
- Critical Thinking/Analytical/Problem solving
- Policy/Standards
- Research and Development/Innovation
- Distance/Online Learning
- Education/Curriculum/practical
- Partnership
- Funding/Facilities/infrastructures
- Access to Training and CPD
- Quality Teaching Learning
- Access to Digital Technology across all Sectors

X-axis: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

Analysis: After a thorough analysis of the responses received; we have classified it in 12 critical challenges as presented in the graph. The participants considered access to digital technology the key to development across all engineering sectors, therefore they prioritised access to digital technology as the first challenge for Engineers bearing in mind the rapid changes in technology. This includes use of VR and AR, introducing modern technology in universities and schools, and also use technology to monitor performance and etc. Meanwhile they prioritised quality of teaching and learning using digital technology as the second challenge. And once again the participants considered adult education and CPD very important throughout life of a professional considering rapid changes in technology and therefore they prioritised access to CPD as the third challenge. This includes proposing capacity building through staff exchange, new digital technology trainings about know- how of technology in addition to attending workshops and conferences, and international exchange of experience programmes.
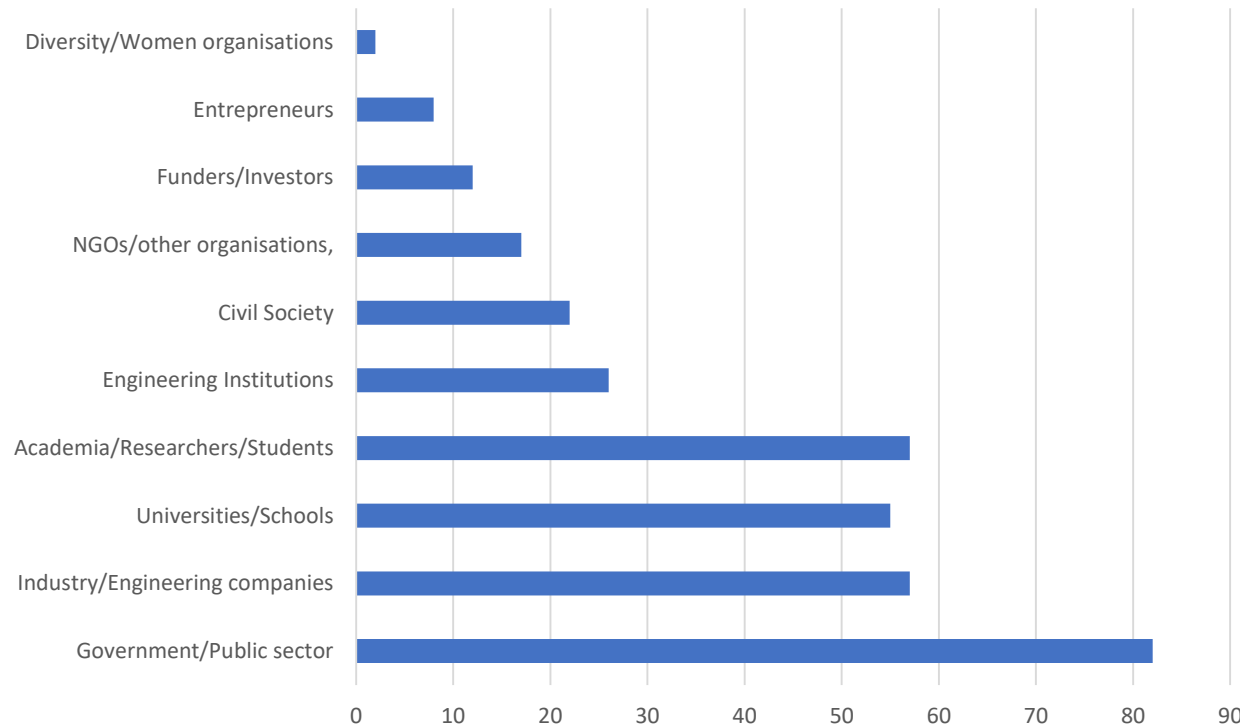
Project Proposals: We will consider project proposals addressing a need in any of the prioritised critical challenges to address issues related to emerging digital technology across any discipline of engineering to enhance access to digital technology and also enhance teaching and learning. However, considering the funds availability, we will consider project proposals that addresses one of the top three critical challenges.

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Question 4

Who are the most important stakeholders to engage with in order to address these needs?

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Key Stakeholders

Key Stakeholders

Horizontal bar chart showing Key Stakeholders (from top to bottom):
- Diversity/Women organisations: ~2
- Entrepreneurs: ~8
- Funders/Investors: ~12
- NGOs/other organisations,: ~17
- Civil Society: ~22
- Engineering Institutions: ~26
- Academia/Researchers/Students: ~57
- Universities/Schools: ~55
- Industry/Engineering companies: ~57
- Government/Public sector: ~82

X-axis: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90

Analysis: After a thorough analysis of the responses received; we have classified the stakeholders in 10 areas of engagement as presented in the graph. The participants consider government and public sector engagement the key to development across all engineering sectors, therefore they prioritised it as the first challenge for Engineers. This includes proposing engagement of ministers as decision makers such as ministries of education, transport, planning, research, technology, and Communication and Information, industry, finance (to loosen up tight tax/financial regulations), water and energy ministries, parliament members, employers, policy makers and etc. Meanwhile they prioritised industry and engineering company's engagement as the second challenge. And finally, the participants ranked schools and universities engagement as the third challenge.

Project Proposals: We will consider project proposals that addresses a critical challenge that engages key stakeholders into the project. We encourage partnership with any of the stakeholders as shown in the graph such as government bodies, industry, universities, academia and students, and engineering institutions.

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Participants Profession & Education Level

Analysis: After a thorough analysis of the responses received; we have classified the 143 survey participants profession in 5 diverse categories and their education level into 4 levels of education. Majority of survey participants were either a professional engineer or Academia as presented in the Participants Profession graph. And as shown in Participants Education Level graph – majority of the survey participants were highly qualified up to PhD and master's or Postgraduate. We also received good level of response from scientists/researchers, engineering students and other people involved in engineering in one way or another.

Participants Profession

Participants Education Level

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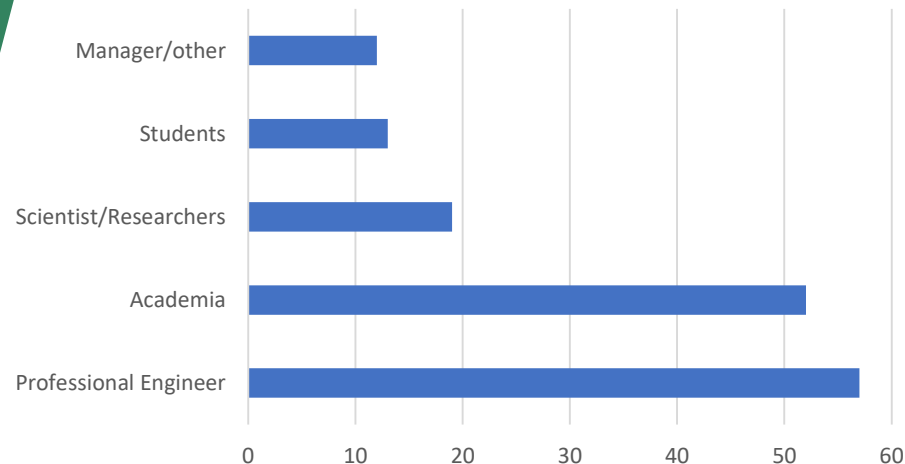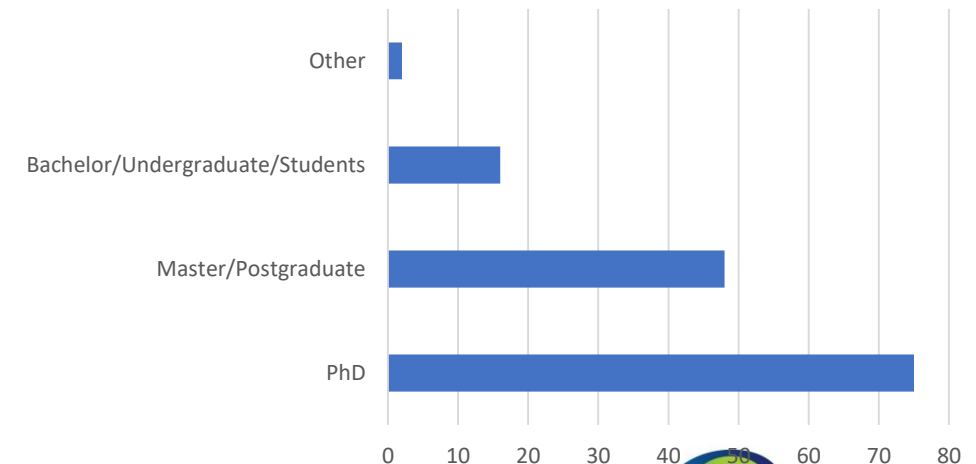
Thanks

- Questions/Comments/Suggestions