Royal Academy of Engineering

ECORYS Answering tomorrow's challenges today

GCRF Africa Catalyst Year Two Deep Dive Report

How can professional engineering institutions in sub-Saharan Africa best engage with decision-makers?

February 2021

Authors and contributors

Lead author

Olivia Geymond

Other authors and contributors

Sarah Hanka

David Crane

Lucia Soldà

Jonathan France

Andrea Broughton

Denis Van Es

Acknowledgements

This report was developed by **Ecorys UK** on behalf of the **Royal Academy of Engineering**, UK. The research was led by Olivia Geymond (lead author and manager of the research) with contributions from David Crane, Sarah Hanka and Lucia Soldà (country case study researchers), Andrea Broughton (director) and Denis Van Es (independent consultant). We are extremely grateful to all interviewees listed in the annex of this report, who contributed their time and valuable insights to this research.

The research was funded by the Global Challenges Research Fund (GCRF) and commissioned by the Royal Academy of Engineering, UK, as part of the GCRF Africa Catalyst programme. Special thanks go to the Academy's GCRF Africa Catalyst team for its inputs and support throughout the research: David Thomlinson FREng, Wariara Waireri, Catriona MacArthur, Gaelle Elisha, as well as the GCRF Africa Catalyst Steering Group.

The photographs featured in this report were taken by Kit Oates.

Contents

List of acronyms 4

Executive summary 7

Introduction 10

Section 1: engagement with policymakers 13

1.0 The stakes of policy influencing 14
1.1 Capacity building of the local workforce 15
1.2 The fight against unregistered engineers 16
1.3 Promoting greater diversity 16
2.0 The challenges of policy influencing 17
2.1 Limited influence of the engineering profession 17
2.2 Corruption and political interference 18
2.3 Lack of policy-skilled staff and networks 18
2.4 Structural limitations of Professional Engineering Institutions' influence 19
3.0 Effective ways to engage with policymakers 20
3.1 Involving policymakers in Professional Engineering Institution activities 20
3.2 Providing expert advice and thought leadership 22
3.3 Collaborating with the government for capacity building 23
3.4 Recommending appointees to government 24

Section 2: engagement with industry 25

4.0 Relations with industry: state of play and challenges 26
4.1 Effective engagement with industry 26
4.2 Fostering an enabling environment for the private sector 27
4.3 Bridging the gap between academia and industry 28
4.4 Facilitating the entry of young graduates into industry 28

Section 3: engagement with academia 29

5.0 Accreditation and improving the quality of tertiary education 30
5.1 Co-developing industry-oriented curricula 31
5.2 Competitions and awards 32
5.3 Developing online education offer 33

Section 4: engagement with the media 34

Section 5: recommendation 37

Annex I : country chapters 41

6.0 Nigeria 42
7.0 Sierra Leone 52
8.0 South Africa 58
9.0 Uganda 66
10.0 Zimbabwe 79

Annex II: references 90

List of acronyms

Acronym	Definition
APWEN	Association of Professional Women Engineers of Nigeria
ACEK	Association of Consulting Engineers of Kenya
CAC	Committee on Anti-Corruption
CEASA	Clinical Engineering Association of South Africa
CESA	Consulting Engineers South Africa
COET	Chamber of Engineering Technology
COREN	Council for the Regulation of Engineering in Nigeria
CPD	Continuing Professional Development
DSTI	Directorate of Science, Technology and Innovation
EAC	East African Community
EAP	Engineers Against Poverty
ECSA	Engineering Council of South Africa
ECZ	Engineering Council of Zimbabwe
EFN–UK	Engineering Forum of Nigerians – UK
ERB	Engineers Registration Board
ERC	Engineering Registration Council
FAEO	Federation of African Engineering Organisations
FAFME	Forging Africa's Future Mechanical Engineers
FCDO	Foreign, Commonwealth and Development Office
FIDIC	International Federation of Consulting Engineers
FIDIC GAMA	International Federation of Consulting Engineers Group of African Member Associations
HVACR	Heating, Ventilation, Air Conditioning and Refrigeration
IAESTE	International Association for the Exchange of Students for Technical Experience
IEEE	Institute of Electrical and Electronics Engineers
IEEE-SA	Institute of Electrical and Electronics Engineers South Africa Section
IEK	Institute of Engineers Kenya

Acronym	Definition
IET	Institution of Engineers Tanzania
IMechE–UK	Institution of Mechanical Engineers – UK
IMESA	Institute of Municipal Engineering of Southern Africa
KCCA	Kampala Capital City Authority
MRA	Mutual Recognition Agreement
MOU	Memorandum of Understanding
NAE	Nigerian Academy of Engineering
NESAC	National Engineering Students Awards Competition
NIC 2.0	NIMechE Innovation Challenge 2.0
NIEE	Nigerian Institute of Electrical and Electronic Engineers
NIMechE	Nigerian Institution of Mechanical Engineers
NSE	Nigerian Society of Engineers
PASAE	Pan-African Society of Agricultural Engineers
PEI	Professional Engineering Institution
PPDA	Public Procurement and Disposal of Public Assets Authority
PPP	Public–Private Partnership
SAAE	South African Academy of Engineering
SAFCEC	South African Forum of Civil Engineering Contractors
SAFE	South Africa Forum of Engineering
SAIAE	South African Institute of Agricultural Engineers
SAICE	South African Institution of Civil Engineering
SAIChe	South African Institution of Chemical Engineers
SAIEE	South African Institute of Electrical Engineers
SAIIE	Southern African Institute for Industrial Engineering
SAIMechE	South African Institution of Mechanical Engineering
SALGA	South African Local Government Association

Acronym	Definition
SLIE	Sierra Leone Institution of Engineers
SLWE	Sierra Leone Women Engineers
SPE	Society of Petroleum Engineers
SPHEIR	Strategic Partnerships for Higher Education Innovation and Reform
SSA	Sub-Saharan Africa
STEM	Science, Technology, Engineering, and Mathematics
UACE	Uganda Association of Consulting Engineers
UCICO	Uganda Construction Industry Commission
UGX	Ugandan Shillings
UIPE	Uganda Institution of Professional Engineers
UNABCEC	Uganda National Association of Building and Civil Engineering Contractors
UNIDO	United Nations Industrial Development Organization
UNRA	Uganda National Roads Authority
WFEO	World Federation of Engineering Organizations
YCF	Young Contractors Forum
YPF	Young Professionals Forum
ZBEPT	Zimbabwe Built Environment Professionals Trust
ZIE	Zimbabwe Institution of Engineers
ZIMCHE	Zimbabwe Council of Higher Education

Executive summary

Professional Engineering Institutions (PEIs) have an essential role to play in advancing engineering across sub-Saharan Africa (SSA) in order to achieve structural transformation and poverty alleviation within the region. Such advancements are only possible if PEIs develop relationships with a variety of key stakeholders, including policymakers, industry actors, academia, and the media. This research explores how PEIs have nurtured these relationships to achieve successful collaborations and promote the agenda of the profession, with a focus on five case study countries: Nigeria, Sierra Leone, South Africa, Uganda, and Zimbabwe.

Engagement with policymakers (Section 1)

The most prominent issues within the engineering industry in SSA can only be addressed if policy adapts to the evolving nature of the profession; for example, the need to implement higher standards of competence and conduct, and to diversify the workforce. Therefore, it is vital that PEIs influence policy to reflect the best interests of the industry through engagement with policymakers. Key initiatives included in this report include PEIs lobbying their governments to increase the participation of local engineers in large infrastructure projects, and PEIs working to raise the standards that regulate entry to the profession.

PEIs face several barriers in their efforts to influence policy, such as the limited recognition of the engineering industry's potential in achieving sustainable development, as well as corruption within government departments, which obstructs constructive dialogue. However, a number of strategies have been identified as effective in engaging with policymakers, including (i) involving policymakers in PEI activities, (ii) collaborating with the government to build its engineering capacity, and (iii) recommending engineering appointees to executive positions.

Engagement with industry (Section 2)

Expanding collaboration and partnerships between PEIs and industry is also imperative and can be mutually beneficial: PEIs can represent their members' interests to the industry by promoting the hiring of under-represented groups, and tend to have more legitimacy to government bodies than for-profit organisations. PEIs can act as mediators and voice the industry's concerns. However, cooperation remains limited – partly because PEIs are dominated by public sector employees who lack industry connections and experience, and also because the incentives for industry actors to collaborate are not clearly communicated.

According to our research, interventions that best enhance engagement between PEIs and industry are those that accurately respond to the needs of the private sector. These include bridging the gap between academia and the industry, supporting the transition of young graduates into the industry, and fostering an environment in which the private sector can expand and thrive, through activities such as facilitating domestic financing and foreign investment.

Engagement with academia (Section 3)

Relationships between the reviewed PEIs and academia tended to be more established, at least partly because a significant number of those on the boards of PEIs also work in universities, and because PEIs tend to be responsible for accrediting engineering courses. There are several examples of successful initiatives implemented by PEIs to engage with academia and strengthen their relationships, including establishing student chapters at universities, mentoring students and providing them with information about the engineering profession, developing online learning platforms, and running competitions that provide students with a platform to showcase their innovative ideas and technical knowledge.

Engagement with the media (Section 4)

Press coverage and social networks are a vital tool for showcasing engineering priorities, as well as the work that PEIs are doing and how this is contributing to developmental progress. PEIs employ a range of different media and communication tools to share news about important events, promote job vacancies, and voice the concerns of the relevant engineering sectors. However, there is room for PEIs to improve their online presence and leverage the media to further establish their credibility.

Recommendations

The research has identified several recommendations for PEIs in SSA to strengthen their engagement with key stakeholders:

- Ensure that their staff have the necessary capacity to influence policy, including the ability to effectively communicate technical issues to policymakers, and knowledge of the political landscape and relevant government departments.
- Continue building their visibility among policymakers to attract wider professional support.
- Identify the needs of the industry and make joint-value propositions.
- Collaborate more widely with international and supranational bodies, including other PEIs.
- Expand monitoring and evaluation efforts to establish their credibility.
- Use digital media and analytics to influence policy.

Introduction

Why this research?

PEIs have an essential role to play in promoting and developing the engineering profession to achieve sustainable development in SSA. To address the evolving needs of the profession, they need to work hand in hand with key national and supranational decision-makers: policymakers, key industry players, academia, and the media.

This research aims to capture how SSA PEIs can best nurture collaboration with key stakeholders, in particular policymakers, to advance the agenda of the profession. Ultimately, the goal is to showcase successful examples and spur inspiration and learning among SSA PEIs. This research is not designed to be exhaustive, but rather to showcase some of the most interesting initiatives across five countries in SSA.

Research questions

The research aimed to address the below questions, structured around five areas.

African PEIs' relations with policymakers

- How well-connected are PEIs with national policymakers (government, parliament, government agencies, etc.)? What is the nature of these relations?
- What are the challenges of engaging with national policymakers?
- What do successful examples of policy influencing look like?
- What do successful examples of cooperation with policymakers look like?

African PEIs' relations with industry

- How well-connected are PEIs with industry and the private sector?
- What is the nature of these relations?
- What do successful examples of cooperation look like?

African PEIs' relations with academia

- How well-connected are PEIs with academia and universities in particular?
- What is the nature of these relations?
- What do successful examples of cooperation with academia look like?

African PEIs and the media

- How well do PEIs leverage the media to promote and advocate for engineering priorities?

Opportunities and recommendations

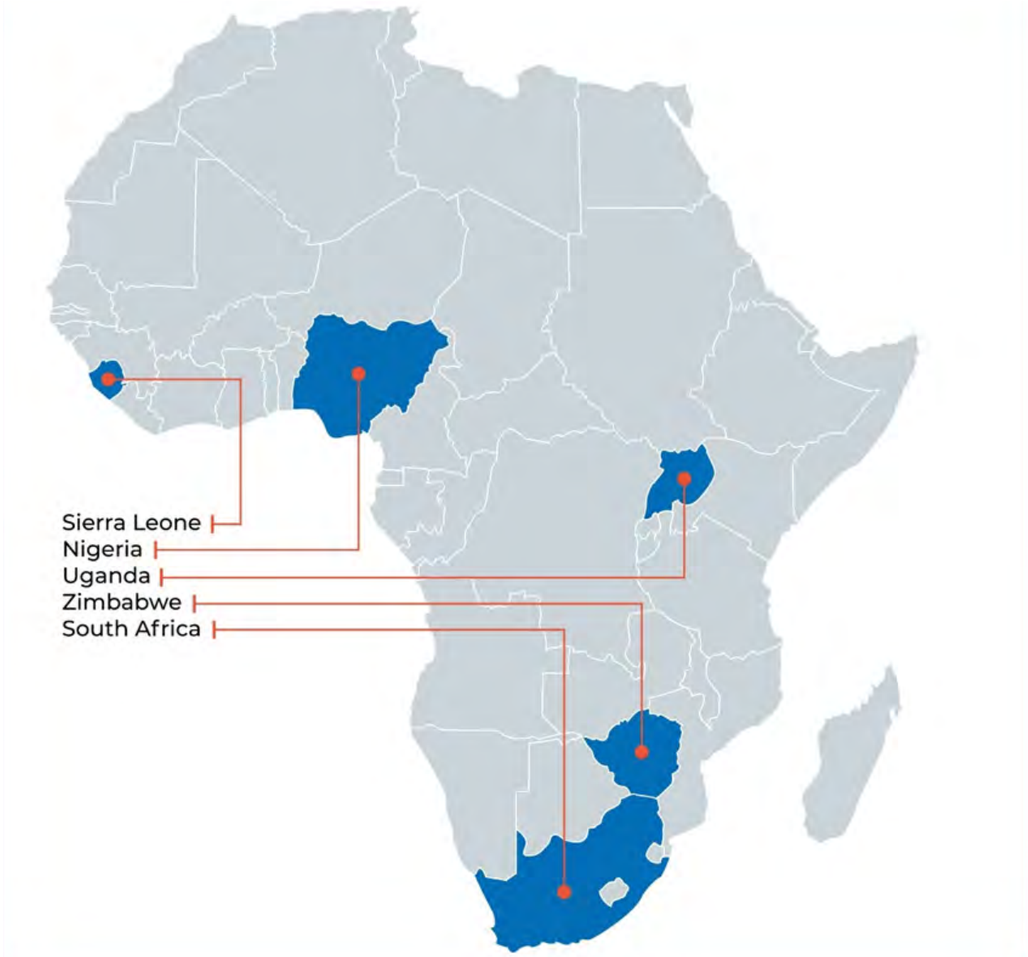
- What are the lessons learned from national PEIs on how to best engage with key decision-makers?
- What could African PEIs do to further contribute to shaping public policy?

Methodology

In discussions with the Royal Academy of Engineering, we selected five countries to be covered by this research based on early evidence of effective stakeholder engagement practices: Nigeria, Sierra Leone, South Africa, Uganda, and Zimbabwe. Three of these countries (Sierra Leone, Uganda and Zimbabwe) were covered in more depth in detailed case studies, while two (Nigeria and South Africa) were covered in rapid case studies, as the team could already build on fieldwork carried out in these countries in year one of our research. Kenya was not selected as a case study, but insights from the first year of the research have been reflected in this report.

Our methodological tools included a desk review and semi-structured interviews with a range of engineering stakeholders in each of the five countries covered. We carried out a thematic analysis of the qualitative data gathered. Drawing on these findings, we crafted recommendations on how PEIs can best engage with key decision-makers.

Figure 1: Overview of the five countries targeted by the research



Section 1: engagement with policymakers

SSA PEIs' core mission is to advance engineering by raising the profile of the profession and promoting high standards of technical competence, conduct and ethics. To achieve their mission, it is essential for PEIs to influence policy to reflect the constantly evolving needs of the profession. Engineers have little involvement in policy matters, however. This is deeply problematic: there are many examples where governments have embarked on large and costly infrastructure projects without sufficient engineering input, leading to ill-suited outcomes[1]. Influencing policy is an arduous endeavour, but our research identified a range of successful initiatives in the five countries covered that demonstrate the extent of what can be achieved by engineers.

1.0 The stakes of policy influencing

The range of issues facing engineering in the countries covered by this research make it essential for PEIs to engage with policymakers in shaping relevant policies. This includes addressing the capacity-building needs of the local workforce, the fight against unregistered engineers, the need for greater diversity in the profession, and its requirement for updated regulations to meet its evolving needs .

While this research does not cover engagement with policy at a supranational level, it is worth noting rising demand for the creation of an African Council of Engineering, which could operate under the auspices of the African Union (AU)[2]. This would help PEIs address the issues they face at the national level in a more coordinated manner, levelling the playing field. Currently, different countries have different standards for engineering practice and engineering education, making mobility and cooperation difficult across SSA.

Figure 2: Challenges for the engineering profession that require engagement with policymakers

Capacity building of the local workforce

Unregistered engineers

Greater diversity in the sector

1 Engineering: Issues, Challenges and Opportunities for Development, UNESCO, 2010.

2 'Pan African engineering body needed', Engineering News, 6 June 2014.

1.1 Capacity-building of the local workforce

PEIs in SSA have long been lobbying national governments to promote local engineering communities by making use of the skills and capabilities of local firms. In many SSA countries, public procurement contracts are disproportionately contracted to foreign firms, which tend to hire foreign staff. This harms the local engineering workforce by depriving them of work and experience-building opportunities. Our research identified a number of practices to counteract this trend. The box below gives details of strong practices in Uganda and Kenya.

Uganda - Uganda Institution of Professional Engineers (UIPE)

UIPE successfully lobbied the Public Procurement and Disposal of Public Assets Authority (PPDA), the regulator of public procurement, to set a threshold below which public procurement contracts must be awarded to national and resident providers. In addition, foreign contractors must subcontract at least 30% of the value of their contract to local contractors. In 2020, the PPDA reported on the progress made through this reservation scheme and noted there had been an "increase in the value of contracts for work awarded to local providers". To date, the scheme applies to all publicly procured engineering projects, except in the oil and gas industry.

Uganda - Uganda National Association of Building and Civil Engineering Contractors (UNABCEC)

UNABCEC successfully influenced the substance of the National Local Content Bill 2019 to prioritise Ugandan citizens and companies every time public money or natural resources are involved. It did so through proposing amendments to the Parliamentary Committee on Finance, Planning and Economic Development. The Bill was successfully passed by the Parliament in May 2020, although it is yet to be enacted by the President as compatibility issues have been raised with the East African Monetary Union.

Kenya - Association of Consulting Engineers of Kenya (ACEK)

ACEK has been actively voicing the concerns of consulting engineers on evolving company ownership requirements set by the government. While engineering companies are usually owned by business executives who are able to bring the necessary financial capital, the Kenyan government introduced a regulation requiring all shareholders to be registered as professional engineers. In practice, foreign companies are able to bypass this requirement through complex ownership structures, putting local companies at a disadvantage.

1.2 The fight against unregistered engineers

PEIs are also active in calling for action against threats posed by unregistered engineers in SSA (particularly in Uganda, Kenya and Nigeria). Many engineers are not registered in these countries (out of 20,000, only 1,500 professional engineers were registered by the Engineers Registration Board (ERB) Uganda as of October 2018[3]). Among them, a number of engineers are not qualified to practise. This contributes to a range of problems, including building collapses. The boxes below give details of practices to combat this.

Uganda - UIPE and ERB

- UIPE and ERB actively advocate for engineers to register with the ERB, and for companies to exclusively hire registered engineers.
- They also call on the government to enforce the existing provisions of the Engineers Registration Act, pointing out that the government itself employs many people in engineering positions that are not registered. They organise outreach activities to raise awareness among local government and 'demystify the process of registration'. The ERB further calls on urban authorities not to approve engineering projects unless lead engineers are registered with the ERB.
- ERB is actively demanding that authorities take punitive measures against unregistered engineers.

Uganda - UNABCEC

Similarly, UNABCEC successfully influenced the Uganda Construction Industry Commission (UCICO) Bill, to regulate the awarding of engineering contracts and fight the issue of 'briefcase contractors' who are not registered with UNABCEC. In response to demand from UNABCEC, the Bill grants authority to UNABCEC to act against fake contractors. The Bill is yet to be enacted at the time of writing this report.

1.3 Promoting greater diversity

PEIs also lobby governments to expand diversity. They stress that excluding segments of a country's population from the profession deprives it of the diversification of its workforce, social benefits, the empowerment of women and in turn of families and communities. Examples of initiatives to raise awareness about the issue include those in the boxes below.

South Africa - Black Business Council in the Built Environment

The Black Business Council in the Built Environment engages government and other statutory bodies to influence the drafting and implementation of appropriate legislation, in order to create an enabling environment for the Black constituency in the building and construction industry.

Nigeria - Society of Petroleum Engineers (SPE)

The former chair of the SPE regularly publicly calls for the promotion of gender diversification in the energy sector.

3 'Quack engineers put Uganda's construction sector on edge', Nile Post, February 2021.

2.0 The challenges of policy influencing

Across the countries covered by this research, PEIs face similar challenges when trying to influence policy, as set out in the figure below.

1. **Limited influence of the engineering profession**
2. **Corruption and political interference**
3. **Lack of policy-skilled staff and networks**
4. **Structural limitations of PEIs' influence**

2.1 Limited influence of the engineering profession

SSA PEIs regret there is still insufficient recognition of the value of engineering in their countries, and in particular of the contribution of engineering to achieving economic development and societal progression. Many PEIs feel that engineering is not seen as essential, and smaller engineering specialisms, such as agricultural engineering, receive even less consideration.

The brain-drain of qualified engineers going abroad, and the outsourcing of national engineering projects to foreign firms make it difficult for national engineers to gain essential industry knowledge and practical experience, limiting their development and expertise. In addition, not all engineers register, which weakens the legitimacy of PEIs to represent the entire profession to the government. In South Africa, an additional challenge is the lack of trust between the government and professional engineers, exacerbated by segregation issues. Public services (and even some PEIs) tend to be dominated by white staff, meaning that people from different races and ethnicities do not feel represented by them.

These factors are reported to stifle opportunities for meaningful dialogue with policymakers; government representatives are viewed by PEIs as not seeing the value of engaging with engineers, and sometimes even refusing to do so. Engagement opportunities are limited, and PEIs compete with other more influential private sector actors, that are more successful at attracting the government's attention. Due to limited resources and time, policymakers are often not willing to duplicate efforts unless they are confident in the 'added value' of PEIs.

2.2 Corruption and political interference

PEIs interviewed for this research deplore that corruption prevails within government departments, leading policymakers to prioritise benefits for their own constituency over a coherent national strategy or ensuring that resources are allocated efficiently across the country. They state that this makes it difficult to hold a constructive dialogue.

Another reported obstacle is the short-term nature of politics in SSA. Policymakers are frequently replaced and fail to enact long-term policies[4]. Every time decision-makers change, any progress is reset, and strategic priorities frequently shift. Political priorities not only shift with election cycles, but are also sometimes conflicting or contradictory between departments[5]. Government ministries often battle multiple priorities, which means that issues without the backing of other sectors are unlikely to receive attention. There is also a variance in culture and responsiveness between government departments, with some more open to dialogue than others.

In Zimbabwe, for instance, the Ministry of Science and Technology is reported to be receptive to requests from science, technology, engineering, and mathematics (STEM) non-profit organisations, because 'they speak the same language', while the Ministry of Education faces different pressures and looks to other industries for expertise, especially as engineers do not always successfully articulate the added value they can bring them[6].

Finally, even where dialogue is opened, PEIs feel that there is limited follow-through due to the lengthy and sometimes complex political processes needed for change. A striking example can be found in Sierra Leone, where the Sierra Leone Institution of Engineers (SLIE) and the Engineering Registration Council (ERC) have continuously been calling for a revision of the 1990 Professional Engineers Act to reflect the evolving needs of its mission. However, despite securing buy-in of the President of Sierra Leone himself, the Act remains unchanged to date.

2.3 Lack of policy-skilled staff and networks

Influencing policy is a demanding endeavour that requires specific soft skills; notably, the ability to think strategically and to communicate complex technical matters into intelligible demands. It also requires an understanding of public policy to seize the right opportunities for influence and identify the best actors to approach. Engineers do not usually learn such skills in their training, meaning that they can struggle to articulate the challenges faced by engineers in the field, and struggle to sell the value of their policy proposals to non-technical audiences.

An additional challenge for PEIs is the lack of financial and human resources; budget tends to be channelled to immediate priorities, such as capacity-building and accreditation work. For many PEIs, committing resources to advocacy is a luxury. Furthermore, most PEI staff have limited capacity as they tend to be volunteers who juggle their roles with a full-time job. Policy influencing requires capacity and commitment that many PEIs do not have, especially as policy proposals need to be tailored to different policymakers. To be effective, policy influencing efforts also need to be implemented over the long term, through relationship building with a consistent face for policymakers. The few PEIs that manage to free some time for their CEOs to be a consistent and well-informed face for advocacy tend to achieve more.

Even where PEIs have the skills and capacity to advocate for policy change, they sometimes lack the networks and relationships within public bodies to access policymakers. They also face a lack of socioeconomic data, including on databases of registered professionals or statistics on employment patterns, making it difficult for them to provide useful advice.

2.4 Structural limitations of PEIs' influence

One factor limiting PEIs' influence is the fact that some are directly attached to government departments, constraining their ability to be critical of the government's actions or to push more aggressively for reforms that they perceive as paramount for the profession's success. This is the case, for instance, of the SLIE, which is overseen by the Ministry of Work. This hierarchical relationship is reported to regularly cause frustration within the organisation. Similarly, in Kenya, the perception of the Institution of Engineers Kenya as 'subordinate' to the Engineers Board of Kenya makes it difficult for the institution to distance itself from or criticise government policy, and to be seen as the voice for the protection of engineers' welfare.

Another structural limitation of PEIs' influence is situations when their advice is not binding, and when they are only one of several actors that policymakers can consult. This has been the case with the EBR in Uganda. As a statutory body established through an Act of Parliament, it enjoys close links with policymakers, but its recommendations to the government are not binding and can therefore easily be ignored.

Finally, the diversity and fragmentation of engineering organisations in some countries, such as South Africa, can make it difficult for PEIs to agree on common topics when engaging with policymakers. This fragmentation hampers the strength of engineers' demands. South African PEIs have been trying to come together as part of the South Africa Forum of Engineering (SAFE) to achieve better results. While greater collaboration is needed, promising joint efforts have taken place, for instance between SAFE and the Department of Public Works and Infrastructure about achieving effective and financially sustainable continuing professional development (CPD) courses.

4 Interview with Sierra Leone PEI.

5 Interview with Zimbabwe PEI.

6 Interview with Purple Future Trust.

3.0 Effective ways to engage with policymakers

Figure 3: Effective ways in which PEIs engage with policymakers

3.1 Involving policymakers in PEI activities

Interviews revealed that an important success factor for effective policy influencing is to maintain a regular dialogue with policymakers and in particular national governments. A simple way of achieving continued engagement is to involve policymakers in PEI activities. The annual conferences, or other high-level events organised by PEIs, are an excellent way of doing this. Inviting high-level policymakers to deliver keynote addresses is a simple way of networking and opening up a dialogue on substantial matters. This is also an opportunity to raise the awareness of policymakers about the contribution of engineering to socio-economic development and the challenges faced by the profession.

A recent example is the Institution of Engineers Kenya (IEK) Annual Conference 2020, where the Cabinet Secretary for Transport, Infrastructure, Housing and Urban Development was invited to deliver an address at the opening session. The conference was an opportunity for the IEK to reiterate its call for institutional and legislative framework improvements for delivering engineering services more efficiently, and to provide opportunities for engineers to be appointed to the boards of state agencies.

Organising ad-hoc events around a topical issue is also seen as an efficient practice. For example, UNABCEC organised a Stakeholders' Engagement Forum in July 2019, where its president directly addressed the Minister of State of Works, calling for a government programme to build the capacity of local contractors to construct paved roads. The minister responded favourably, acknowledging that local contractors were not able to compete for projects with foreign firms and that their capacity needed to be built.

As another example, the Zimbabwe Institution of Engineers (ZIE) organised a conference on infrastructure development in 2018, designed to engage policymakers, practitioners and researchers in finding solutions for leapfrogging infrastructure availability to support rapid economic growth, reduce poverty and inequality in Zimbabwe, and inspire action towards change. The conference was opened by the president of the country and featured eight government ministers, who were then able to meet engineers privately and discuss priorities for the engineering profession. For more details, see the box below.

ZIE's efforts to engage policymakers on topical issues

The latest infrastructure annual development conference, entitled 'Accelerated Infrastructure Investment, Development and Delivery', was held in Victoria Falls from 2 to 4 July 2018. The event was officially opened by the President of Zimbabwe, E.D. Mnangagwa, who also met privately with ZIE representatives, including the Zimbabwe Built Environment Professionals group, comprising engineers, architects, contractors, quantity surveyors and geomatics, real estate, environmentalists and town planners. As well as the president, the conference was attended by over 350 people, including the following government representatives, who delivered speeches:

- Joram Gumbo (Minister of Transport and Infrastructural Development)
- Supa Mandiwanzira (Minister of Information Communication Technology and Cyber Security)
- Oppah Muchinguri (Minister of Environment, Water and Climate)
- Simon Moyo (Minister of Energy and Power Development)
- Mike Bimha (Minister of Industry, Commerce and Enterprise Development)
- July Moyo (Minister of Local Government, Public Works and National Housing)
- Sibusiso Moyo (Minister of Foreign Affairs and International Trade)
- Winston Chitando (Minister of Mines and Mining Development)

Some of the issues raised acquired broader attention through websites such as ZimbabweSituation.com, which highlighted concerns such as skills shortages among local engineers, the need to improve training for students in tertiary institutions to enhance industry attachment and a revival of apprenticeship programmes. Furthermore, a specific Facebook page has been set up by ZIE to capture learning and exchange information after the conference, as well as to promote other events such as Women's History Month, World Engineering Day Celebrations, the Global Engineering Conference (GECO 2020) and 2020 World Federation of Engineering Organizations (WFEO) Executive Council Meetings. The page currently has almost 500 followers and 500 likes.

Similarly, the Nigeria Society of Engineers (NSE) regularly organises events to raise awareness within the government about the contribution of engineering to local economic development. Through week-long innovative and creative fairs, the NSE showcases products made from locally available materials that solve environmental challenges in health, agriculture, social media and solar energy. It argues that this has directly contributed to the enactment of an executive order to improve local content in public procurement with science, engineering, and technology components.

3.2 Providing expert advice and thought leadership

The window of opportunity for PEIs to influence a policy issue is not continuous and tends to be narrow. Therefore, PEIs need to invest in the issues 'of the day' and be able to deliver the right advocacy products at the right time. This requires strategic thinking, as well as developing solutions ahead of issues being tackled by policymakers. Finally, a key success factor for effective influencing is to focus on a specific policy area (e.g. a contract clause) rather than broader, more abstract political causes. Being clear on what it is that PEIs are trying to achieve is of the utmost importance.

Given how demanding this process can be, it is not surprising that those PEIs that are better resourced have been able to share good examples of how to provide expert advice and thought leadership to their governments. Our research found South African PEIs to be the most active in this regard. A strong example of where PEIs have provided timely advice to feed into policy was their support to the South African government's response to the COVID-19 crisis, as set out in the box below.

PEIs supporting the South African government's response to the COVID-19 crisis

In May 2020, the South African Academy of Engineering (SAAE) sent a letter to President Ramaphosa with engineering advice on addressing post-COVID-19 challenges, envisaging 'a series of advisory notes on crucial issues to inform and support the decisions of all tiers of government'. The letter also stated that SAAE's Fellows would be 'available to provide further information and would be honoured to be called up to engage with government to assist with the implementation of its recommendations'.

In addition, Consulting Engineers South Africa (CESA) was part of the Construction COVID-19 Rapid Response Task Team, a liaison forum with government decision-makers on how to safely get the engineering profession back to work, mitigate damage to the economy and stem the tide of unemployment.

A less recent, but equally interesting, example where a PEI anticipated policy needs and effectively influenced policymaking was the development of a code of practice for building regulations in South Africa in the mid-1990s. For details, see the box below.

A code of practice to support the South African government's housing agenda

When it took power in 1994, Nelson Mandela's government promised to tackle South Africa's housing crisis by building one million homes in five years. The soil composition in parts of the country makes buildings vulnerable to cracks, however, and repairing cracks is expensive, and even unaffordable, for many families. To prevent these issues from arising, the Institution of Structural Engineers developed a code of practice for building regulations and reached out to all government departments asking if they would support the initiative, with no success.

At the time, the industry was setting up a structural national warranty scheme according to which lenders would only repay housing mortgages if the houses bought were crack-free. The Institution of Structural Engineers was able to put its code of practice forward as the initiative was being developed. Since then, it has been compulsory to comply with the code of practice to obtain any mortgage lending finance. A success factor of the code of practice was that it proposed very simple ways of classifying building sites, which even low-level officials could understand and implement easily, and that it was ready at the right time.

Effectively engaging with the government can also take the form of providing timely technical expertise. Under the auspices of the Engineering Council of South Africa (ECSA), South African PEIs met with the Minister of Public Enterprises to discuss the power supply challenges of the public electricity utility, Eksom, which experiences frequent power cuts. Following this engagement, the Ministry tasked the South African Institute of Electrical Engineers (SAIEE) and ECSA with analysing the situation, and make propositions for the South African engineering fraternity to assist with the development of a coherent plan.

Similarly, IEK works closely with the Kenya national and county governments to support the harmonisation of technical regulations. In Kenya, each county sets its own tax regime on natural materials. Different counties therefore have different tax regimes, making it complex for engineering companies to estimate building costs. IEK was tasked with helping to benchmark the different tax regimes and develop standard legislation that could then be customised to the different counties' local situations. IEK developed a memorandum that was very well received by the Council of Governors.

SSA PEIs also exert thought leadership through the **publication of comprehensive technical advice.** Every five years, the South African Institution of Civil Engineering (SAICE) publishes a report *(the Infrastructure Report Card)* that assesses the status of South Africa's infrastructure. The report is used by the government and by WFEO, which decided to adopt it as a model for other countries.

IMESA's web-based tool to build the capacity of local authorities

As part of a National Treasury initiative, IMESA worked with senior engineers to develop manuals and guidelines to build the engineering capacity of local government employees, and support them in addressing issues related to urban planning, rising sea levels and droughts.

IMESA also developed the web-based tool 'Asset Management Programme Learning Environment', and works with the South African Local Government Association (SALGA) to establish a core skills database. The tool is available to municipalities via the IMESA website. IMESA provides capacity building to local authorities (for example, through its annual conferences) and collaborates with SAIEE on electrical engineering issues.

3.3 Collaborating with the government for capacity building

Another effective way to engage with policymakers is by building the engineering capacity of government. Beyond the obvious benefits to government staff, it improves the governance of publicly commissioned engineering projects, and in turn enables engineers to deliver better outcomes. The more that civil servants understand engineering, the more able they are to communicate effectively with engineers and exert informed leadership over infrastructure projects. This also spurs greater trust between government staff and builders.

The best practices identified by our research in this field come from South Africa. The Institute of Municipal Engineering of Southern Africa (IMESA), for example, is involved in a National Treasury initiative to identify and tackle the various challenges for municipalities that are hampering engineering service delivery. For details, see the box to the right.

Another relevant initiative is the *Client Guide for Improving Infrastructure Project Outcomes*, developed by a former president of the South African Institution of Civil Engineering[7]. Infrastructure projects have become more complex over time due to increased environmental concerns, the need to involve multiple professionals, and the need to manage risks. According to the guide, one of the reasons SSA countries such as South Africa struggle to get projects off the ground is due to a lack of understanding from decision-makers on how infrastructure projects come together. Infrastructure project failure can frequently be attributed to a lack of governance and poor procurement and delivery management practices, all of which are under the control of the client. This is why the guide lays out basic standards on 'how to be a good client' when commissioning engineering services. The guide covers the role of the client, the basics of effective delivery, techniques for controlling workflows, procurement strategy and tactics, and designing an effective delivery management system.

Collaboration with the government for capacity building also applies to building the capacity of the profession. A number of PEIs have found it effective to work with the government towards building the capacity of local contractors and suppliers, as well as engineering graduates. In Uganda, UNABCEC is working with the government to build local capacity in the road sector. It has developed a scheme with the Ministry of Works and Transports, the Uganda National Roads Authority (UNRA), and the PPDA to train contractors in bitumen pavement works. UNABCEC members are at an advantage when applying for the scheme.

In the same vein, in Sierra Leone SLIE is working with the Ministry of Finance and the Ministry of Energy to deliver capacity training on soft skills for young engineering graduates from the University of Sierra Leone (USL). The Nigerian Institution of Mechanical Engineers (NIMechE) is working with the Industrial Training Fund, a government agency, to deliver capacity building to new graduates through the 'Forging Africa's Future Mechanical Engineers' (FAFME) project.

3.4 Recommending appointees to government

One final effective way for PEIs to engage with the government is by recommending engineering appointees for executive positions. When these recommendations are taken forward, they have a long-lasting effect on cooperation with policymakers. Indeed, those policymakers who have an engineering background are better placed to understand the challenges and the needs of the profession and are more likely to be receptive to them. PEIs in SSA have long advocated for more engineers to be appointed to government positions.

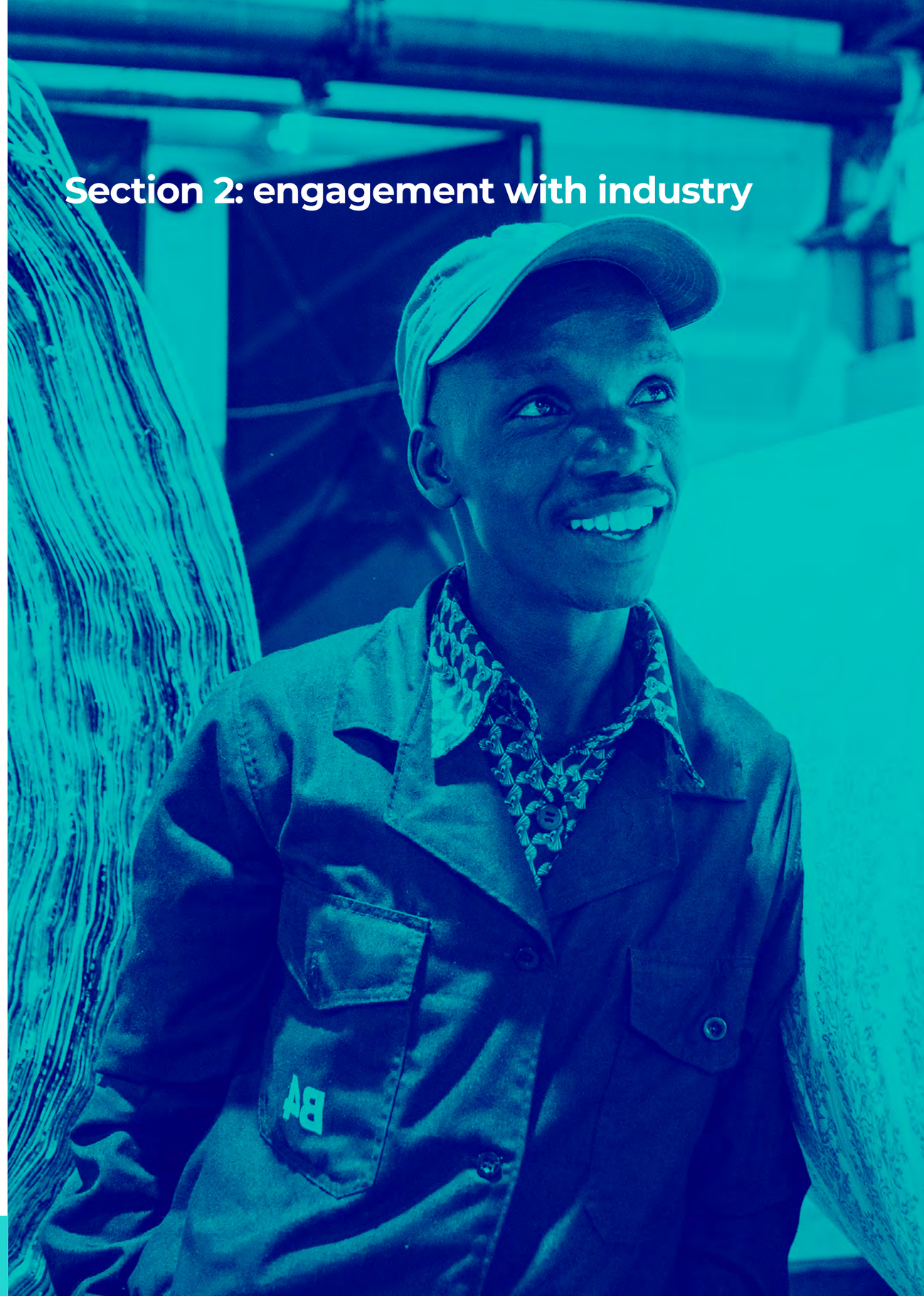
In Uganda, for example, the ERB has long called on the government to stop 'employing incompetent cadres to head technical offices and become supervisors of technocrats'[8], because this could lead to 'new urban slums'. Instead, the ERB stresses that it is important to appoint competent professionals to design new cities and to involve engineers in the planning. For this reason, the ERB has been continuously encouraging government and local authorities to appoint engineers to executive director positions for the management of cities.

ZIE has had great successes in this field. In the past year, it suggested two female appointments who were selected as secretaries in the Ministry for Energy and Power Development, and Ministry of National Housing and Social Amenities. During the same period, two male engineers were elected as permanent secretaries in the Ministry of Transport and Infrastructural Development based on ZIE's recommendations, as well as other positions supporting the Ministry of ICT. ZIE believes that these appointments will be advantageous in increasing the departments' responsiveness to their ongoing advocacy efforts to eliminate brain drain and prioritise the employment of local engineers.

7 Client Guide for Improving Infrastructure Project Outcomes, Ronald Watermeyer, April 2018.

8 Engineers' board trashes approved cities as slums', Daily Monitor, June 2019.

Section 2: engagement with industry



4.0 Relations with industry: state of play and challenges

PEIs in the countries covered by this research recognise that the success of engineering as a profession is greatly advanced through collaboration and partnerships with industry. Furthermore, governments tend to be unreceptive to approaches by commercial organisations that have a for-profit agenda. There is a consensus that PEIs are in a privileged position to act as a mediator between the government and the private sector, to voice the industry's concerns and proposals.

Links with the private sector are limited in the countries covered by this research, however, and more could be done in areas of common interest such as skills supply and demand, and regulation of professional fees. One reason for this limited cooperation is that PEI staff tend to be dominated by public sector representatives who are not always well connected with the private sector and therefore do not always have first-hand insight into the issues faced by engineering firms and independent consultants.

PEIs that have an individual rather than an organisational membership tend to collaborate based on individual contacts. IEK noted that creating greater industry representation in leadership was a successful way to naturally improve collaboration. This has led to the introduction of new initiatives, focused on cooperation with industry, in recent years[9].

Another challenge when cooperating with industry is the difference in working culture; namely in terms of workflow, processes, resources and funding mechanisms. Some PEIs feel that the 'for-profit' model is not compatible with the selfless, evidence-based approach they strive to adopt when addressing key engineering solutions. Conversely, private companies find that PEIs lack agility, are slow and bureaucratic, and make collaboration on topical issues in a timely manner difficult.

Finally, a key barrier to collaboration between PEIs and industry can be the lack of clear incentives for companies to invest in joint efforts. Companies seek clear strategic and/or financial benefits when engaging in joint projects, which PEIs are not always able to articulate.

The COVID-19 crisis has improved this situation to a certain degree, as it has resulted in positive opportunities for further collaboration between PEIs and the industry. This was the case in Zimbabwe, where a number of PEIs swiftly joined efforts with companies to develop plans for building a COVID-19 community isolation centre to ease pressure on existing isolation facilities in the country.

4.1 Effective engagement with industry

Despite the variable extent to which PEIs interviewed for this research collaborate with industry, our research identified a range of interventions through which they effectively engage with the private sector. These include fostering an enabling environment for the engineering private sector to thrive, but also (principally) fostering greater links between academia and industry.

Fostering an enabling environment for the private sector

Bridging the gap between academia and industry

Facilitating the entry of graduates into industry

9 Namely, the introduction of a staff-exchange scheme to foster better understanding between academia and industry.

4.2 Fostering an enabling environment for the private sector

PEIs have a role to play in ensuring that engineering in the private sector can thrive and deliver the best possible services in their country. Our research found that PEIs achieve this in a range of ways, including facilitating access to financing for the private sector, supporting foreign direct investment, and simply connecting individual engineering professionals with companies that need their skills. For details of selected examples, see the box below.

UNABCEC's preferential rates and conditions for members

UNABCEC has signed memorandums of understanding with financial institutions and manufacturers of construction material to offer their services at privileged rates and conditions for UNABCEC members. This is to ease access to funding and support the daily running of businesses. **NCBA** Bank, for instance, is offering an exclusive trade finance package to UNABCEC members, giving them access to bonds of up to £100,000 (UGX 500 million) to fund their projects.

NIMechE's efforts to attract foreign investors

NiMechE seeks to attract foreign investors to Nigeria through international events. In September 2019, NiMechE attended a business-to-business conference organised by the Turkish Export Society on heating, ventilation, air conditioning and refrigeration (HVACR). Recognising that Turkey has a large engineering market, and therefore a lot of potential for investing in African engineering, NiMechE's national chair presented recommendations for Turkish industrial technology to those in attendance to encourage them to set up factories and assembly plants in Nigeria, with the aim of promoting employment and local content.

Connecting engineers with opportunities

- SAICE has developed SAICE Connect; a platform designed to connect firms with qualified engineers, technician and technologists.
- ZIE advertises company openings within its networks (including via its Facebook page) and encourages those who are registered with it to apply. ZIE also promotes large public procurement opportunities.

4.3 Bridging the gap between academia and industry

PEIs are in a privileged position to facilitate connections between industry and academia and our research has identified a number of ways in which they achieve this goal. Bridging the gap between industry and academia is essential to foster and scale up innovation as well as to equip engineering graduates with the skills, knowledge and attitudes that the industry requires. PEIs interviewed for this research shared a view that the COVID-19 crisis has improved collaboration, as it has pushed PEIs and private actors to discuss solutions to the crisis.

The most widespread practice is for PEIs to involve academic teachers in delivering CPD courses for professional engineers, training events, or in mentorship schemes. In return, PEIs facilitate the delivery of professionals-led training for academics or students. Finally, PEIs also strive to connect students and professionals. The South African Institution of Mechanical Engineering (SAIMechE) runs an annual conference that connects students and industry members in the Western Cape, for example.

In Zimbabwe, ZIE members are engaged by universities as visiting or adjunct professors on a temporary basis to offer specialist courses. ZIE has also co-organised motivational talks by industry players to encourage students to pursue a career in engineering. In Kenya, IEK runs a collaborative scheme between its academic and private sector members. For details of further schemes, see the boxes below.

IEK's staff exchange scheme

IEK runs a collaborative scheme between its academic and corporate members. IEK established Memoranda of Understanding (MOUs) with four universities through which academic staff members are able to participate in a three-month placement in an engineering company. During this time, they are able to observe, ask questions and carry out basic tasks. In exchange, IEK professionals can teach specialist courses in partner universities.

The Engineering Council of Zimbabwe's (ECZ) industry placements for lecturers

Since 2014, with the financial backing of the Royal Academy of Engineering, ECZ has successfully helped young lecturers gain industry experience via six-month placements that allow them to develop key practical, process and methodology knowledge of engineering before returning to teaching full time. This was implemented as part of the Higher Education Partnerships in sub-Saharan Africa programme, using the University of Zimbabwe as a hub. In total, there were eight institutions (including from Malawi, Mozambique, and Botswana) involved.

4.4 Facilitating the entry of young graduates into industry

The most substantial and widespread type of collaboration between PEIs and industry is focused on helping the transition of young graduates into the workforce. They do so by arranging work placements for graduates, hosting student competitions, offering online educational materials, and leading mentorship schemes. We encourage readers of this report to refer to the toolbox produced by the Global Challenges Research Fund (GCRF) Africa Catalyst research mandate on this topic, as it provides greater detail and examples.

From our research, the success factors for effectively supporting the transition of graduates into the workforce include identification of industry areas that are understaffed, and incentivisation of employers through the provision of a stipend for graduate students, creating savings for employers on labour costs. It is also important to explicitly target underrepresented groups, such as women, to promote greater diversity in the profession. Finally, mentorship schemes yield good results.

Section 3: engagement with academia

Relations between PEIs and academia in the countries covered by this research are relatively well established, particularly with universities. In their simplest form, this includes events to raise students' awareness about the key aspects of engineering practice and the registration process with professional bodies, and the establishment of PEI student chapters in universities. In their more elaborated forms, they centre around accrediting engineering courses; improving the quality of higher education; developing industry-oriented curricula; organising competitions and awards; and developing online education. One of the factors that explains these closer links between PEIs and academia is that PEIs' leadership tends to include academics.

Figure 4: Effective ways in which PEIs engage with academia

5.0 Accreditation and improving the quality of tertiary education

PEIs in the countries covered by this research work closely with national higher education authorities towards accrediting engineering programmes and improving the quality of higher education in their countries. In South Africa, ECSA is mandated to conduct accreditation visits to educational institutions offering engineering programmes. ECZ works closely with the Zimbabwe Council of Higher Education to the same goal. In Uganda, UIPE and ERB have established a tripartite MOU with the National Council of Higher Education to reinforce their supervisory role in the accreditation process. For details, see the box to the left.

ECZ works closely with the Zimbabwe Council of Higher Education (ZIMCHE) towards the same goal

In 2018, ERB and UIPE signed a tripartite MOU with the National Council of Higher Education to reinforce their supervisory role. The Council is mandated to accredit institutions' academic and professional engineering programmes in consultation with UIPE and ERB. Members of the two organisations sit on the Joint Accreditation Committee, the aim of which is to ensure the quality of education and training for engineers at universities and other tertiary institutions in Uganda. Only those with a degree from an accredited course can register with UIPE and ERB. Through this collaboration, UIPE and ERB have room to influence the quality of education programmes, and feed into how the different curricula can address skills gaps.

Beyond accreditation, PEIs work closely with education stakeholders to standardise curricula and improve the quality of education. ECZ, for instance, works closely with other engineering councils in southern Africa, including through the Southern African Federation of Engineering Organisation, to standardise curricula and facilitate the mobility of engineers to work both across the region and internationally. Since 2018, SLIE has been working on improving the quality of tertiary education in Sierra Leone through the Foreign, Commonwealth and Development Office (FCDO)-funded Strategic Partnerships for Higher Education Innovation and Reform (SPHEIR) project[10]. For details, see the box below.

SLIE's efforts to improve the quality of higher education

SLIE participates in the FCDO-funded SPHEIR programme, which aims to facilitate learning with UK universities, including King's College London, to understand how best to design curricula and identify examples of best practice that can be applied to Sierra Leone. During the COVID-19 pandemic, for example, the project shared methods for ensuring continued access to students, such as the use of WhatsApp for communication between students and academic staff. The project has also created the Skills Development Network, which brings together employers from Sierra Leone, representatives from academia, and the Sierra Leone Tertiary Education Commission to tailor curricula to employers' needs.

5.1 Co-developing industry-oriented curricula

As explored in the previous section of this report, PEIs are in a privileged position to bridge the gap between industry and academia. An effective way of contributing towards this goal would be to jointly develop engineering curricula, ensuring that they accurately reflect the needs of the industry. PEIs in the countries covered in this research are all involved in improving engineering curricula in different ways. Most commonly, PEIs take part in bilateral cooperation with universities to tackle specific requests, such as supporting with developing a new engineering specialism curriculum or reforming a curriculum so that it is better aligned with the needs of the local industry. PEIs can contribute the most relevant industry expertise from their membership.

Our research identified more comprehensive efforts in Nigeria, where NSE has engaged in an extensive process to review existing engineering curricula, involving 26 discipline-specific PEIs. See the box below for details.

NSE's mission to develop industry-oriented curricula

NSE established links with universities and colleges as part of its mission to improve their curricula and make them more industry-oriented. The process involved engaging 26 discipline-specific PEIs and providing them with a tool to identify the current gaps between industry and academia, as well as how to bridge them. Based on the tool, discipline-specific PEIs are now establishing connections with respected industry leaders and analysing university offerings together. One of the PEIs involved in the process is the Association of Professional Women Engineers of Nigeria (APWEN), which is very active in promoting education and women in engineering. Features under consideration for this curriculum include mentorship opportunities for students through PEIs that can link them with senior engineers, and summer industry retreats for lecturers to help them incorporate practical insights into their teaching.

10 How can we help students develop the skills that employers and society really need? University-employer engagement in Sierra Leone', SPHEIR Project – Sierra Leone, 15 December 2020.

5.2 Competitions and awards

In the countries covered by this research, PEIs are involved in rewarding engineering excellence in academia by running award schemes and organising competitions. The Chamber of Engineering Technology (COET) and the Southern African Institute for Industrial Engineering (SAIIE) both run award schemes for the best engineering students at technical universities in South Africa. IMESA also grants a 'Best Student Award'[11]. Through showcasing role models and inspiring achievements, such schemes foster healthy competition for excellence among the student body.

PEIs are also involved in the organisation of competitions where high school students and/or university students are grouped into teams to develop solutions to topical challenges in the engineering industry. In the process, they gain practical experience and insights into the needs of the industry. For further examples, see the boxes below.

National Engineering Students Awards Competition

In 2014, ZIE created the National Engineering Students Awards Competition (NESAC), an annual nationwide competition that draws Zimbabwe's brightest undergraduate engineering students together to showcase their technical, communication and innovation skills. In advance of the competition, each participating university holds a preliminary round, finally fielding two candidates for the national competition. Students develop an engineering solution to deliver sustainable clean water, access to health services and improved agricultural practices, among other things, including via ICT and innovative technological solutions. The aim is to promote innovation and the commercialisation of students' projects. Winners receive a trophy and a financial prize. These competitions have now become highly esteemed and attract the attendance of officials from central government and industry, ZIE members, and staff and students from tertiary institutions.

UIPE's COVID-19 Essays Competition

UIPE organised a virtual students' workshop with students from the Busitema and Makerere universities. The workshop was focused on the role of engineering in addressing the challenges created by COVID-19. It called upon Ugandan students to develop essays on how to use 'the skills they have attained thus far to make the best of this time and look forward to post-COVID-19'. Student competitors presented their essays and Eng. Joseph Oriono Eyatu, Commissioner for Rural Water Supply and Sanitation, gave a keynote speech.

11 https://www.imesa.org.za/bursaries

5.3 Developing online education offer

As has been the case in the rest of the world, the COVID-19 restrictions have placed increased pressure on SSA countries to move their educational offering towards online provision. In Zimbabwe, ZIE has formed a partnership for developing a technical partnership for distance learning. In Nigeria, PEIs have seized this opportunity to lead efforts towards developing online engineering education. For details, see the boxes below.

ZIE's partnership for distance learning

ZIE has formed a technical partnership with the Faculties of Agriculture and Technology at Zimbabwe Open University and The Diaspora Engineers. This focuses on providing distance-learning opportunities for practical, hands-on training, theory-based short courses, and long-term jobs for local engineers. It is also designed to help assist graduates with business ventures throughout the country. These online resources are provided on the University of Zimbabwe's website, and focus on two key areas:

- The development of practical entrepreneurial skills and industry critical skills that are competitive in both the national and global marketplace. This specifically relates to the adoption of Education 5.0 policy by the Ministry of Higher and Tertiary Education, Science and Technology Development. This requires universities to work with local communities to identify economic opportunities to not only inform their curriculum trajectory but also the innovation research and development agenda.
- In order to support the reigniting of closing or closed industries, training will be focused on innovation of new industries and 'low hanging fruit' ie. the production of mass goods that have a capacity to be exported for foreign currency revenue generation and also for domestic consumption.

NIMechE's virtual school, in collaboration with 33 Nigerian universities

COVID-19 has been a catalyst for virtual collaboration, which has provided an opportunity for wider reach across multiple engineering stakeholders. NIMechE decided to move all activities delivered through its Royal Academy of Engineering-funded bootcamp online, thus creating a virtual school on engineering and entrepreneurship called 'EngEntrepreneur'.

A key success factor for the virtual school was agreeing on the focus of the online courses with academics, and working directly with PEI members and students to identify skills gaps, as well as members' professional interests. The digital school team was coordinated by the NiMechE National Student Forum. Together, committee members have identified areas where students needed more training to become more employable.

Other divisions of NSE will be able to upload their courses onto the platform to increase the educational offering, as well as encouraing collaboration between PEIs. The NIMechE National Secretariat opened a call for facilitators, while the NIMechE National Student Forum and the student branches that the PEI has in 33 Nigerian universities have been involved in reaching out to potential participants.

Section 4: engagement with the media

Press coverage and social networks are a vital tool for showcasing engineering priorities, as well as the work that PEIs are doing and how this is contributing to developmental progress. Good media coverage can help attract buy-in from the government, funders and the wider public, and help to raise the profile of the profession overall.

Our research found that PEIs employ a range of different media and communications tools:

- Most PEIs have regularly updated websites including house newsletters, news and material from past conferences or learning events.
- Social network accounts: at a minimum Facebook and Twitter. Some PEIs go beyond and curate LinkedIn pages and/or their own YouTube channels (for instance in South Africa there is SAICETV and CE-tv).
- Some PEIs lead marketing campaigns through Facebook and Google Ads to promote events.
- Some PEIs have established their own publications such as: SAICE's monthly magazine the Civil *Engineering Magazine*[12] ; SAIMechE's twice-monthly digital magazine[13]; IEK's *Engineering Magazine Kenya; The Zimbabwe Engineer;* and ACEK's quarterly Consulting Engineer Magazine.
- Press releases.
- PEIs regularly feature in the national media: TV, radio, newspapers and online press.

Typically, PEIs use social networks and the media to share news about their events and webinars, announce deadlines for conference registrations and paper abstract submissions, promote job vacancies, and voice the concerns of the industry through publishing news articles and opinion pieces. UNABCEC, in Uganda, has been particularly active in using the press to voice the concerns of the profession. For details, see the box overleaf.

12 The Civil Engineering Magazine website.

13 SAIMechE's website.

UNABCEC use of the press to voice its concerns of the profession

UNABCEC engages frequently with the media in its policy influencing efforts. UNABCEC features regularly in the press through articles in the print and online media written by its Executive Director, Elizabeth Muhebwa. In a newspaper article of September 2019, Ms Muhebwa outlined seven requests for the government to "assist local contractors [in the construction sector] to build their financial and technical capacities and enable them to compete favourably in the country's infrastructure development". These requests would contribute to creating employment (especially for youth), strengthening the local construction industry and to boosting the economic development of the country. They would help increase the tax revenues through an increased tax base, and prevent economic and human capital outflows.

On behalf of UNABCEC, Ms Muhebwa also used the media to expose "fraudulent practices in procurement of construction works". In an online press article from December 2020, she criticised the procurement practices in the second phase of the Uganda Support to Municipal Infrastructure Development Programme for unfairly favouring foreign firms over local contractors. Ms Muhebwa considered that "these short municipality and city road projects do not fall under the major category projects that require sourcing of foreign firms" and that "national and resident (local) firms have the financial, technical and managerial capability to undertake most of these projects in each municipality/city".

Finally, in a press article from July 2020, Ms Muhebwa stressed that the construction sector "is an essential asset of any country's economy". She proposed several ways for the government to rescue the construction sector, which was hit very hard during the crisis and faced significant challenges even before the COVID-19 pandemic.

UNABCEC also advocates for the sector's interests on radio and television. In an interview with NTV Uganda in 2019, UNABCEC President Karuhanga stated that no major infrastructure government contracts (bridges, roads) had been awarded to local contractors, despite existing capacity to handle such projects. This was followed by another interview with Ms Muhebwa, where she visited areas where local companies had been subcontracted for major infrastructure projects. The interview aimed to show that local contractors, who were usually subcontracted for minor works, had the capacity to handle major projects as well.

The COVID-19 crisis has provided unique opportunities to improve the online presence of PEIs and increase visibility and reach across a wider set of stakeholders. This is beneficial in terms of access to learning and promoting the achievements of PEIs. However, it is apparent that media can be used more proactively by PEIs, or indeed that resources could be dedicated to managing social media accounts and strategies.

Section 5: recommendation

Our research has identified a number of recommendations that the SSA engineering profession could build on to achieve more effective engagement with decision-makers in the years to come. These are set out below.

Build staff capacity for policy influencing

As explored in this report, public policy is the result of intricate exchanges between conflicting interests. Influencing the policymaking process is a complex endeavour, requiring specialised knowledge and skills, including public policy knowledge and bargaining, negotiation and communication skills. It requires the ability to articulate niche technical matters in a way that appeals to a non-technical audience, as well as an understanding of what the public policy stakeholder landscape looks like, including the differing priorities of different government departments. This facilitates the anticipation (and seizing) of opportunities for effective influencing, as openings for influencing are relatively rare.

Against this background, PEIs have a lot to gain by building capacity for policy influencing. Depending on their capacity, they can introduce initiatives ranging from establishing a fully-fledged public policy team made up of professionals, to providing specially designed courses to selected members of their staff on how to influence decision-makers and manage ministerial expectations. This can be undertaken through partnerships with specialised organisations.

In addition, there is value in undertaking a benchmark analysis to identify PEIs' unique value proposition in comparison to other organisations offering similar collaboration or services. This can help articulate more compelling advocacy proposals. PEIs also need to demonstrate how suggested reforms benefit the policymakers being approached.

Continue building visibility

PEIs should continue to build visibility to ensure that their expertise is recognised by policymakers and to attract the support of professionals, including beyond their own members. By raising their profile, PEIs will be able to better access policymakers and raise awareness about the engineering profession and its needs. Better publicising their policy agenda is also a good way to gain attention from those who may not otherwise be interested in membership. This can be achieved by clearly communicating the PEI's specific goals, and the actions it is taking to lobby decision-makers.

Building on the experience of the COVID-19 crisis, there is a significant opportunity for PEIs to build on the newly-gained momentum of the profession. The COVID-19 crisis has prompted SSA governments to look inwards and make the most of the local engineering capacity to handle national infrastructure projects. Governments are therefore more likely to recognise the importance of engineering in national economic activities, and to listen to the demands of the profession. PEIs should work to sustain this momentum.

A key way to build visibility is to maintain regular engagement with policymakers. It is only through continuous dialogue that PEIs can ensure that their demands remain visible. PEIs also need to be smart in focusing their efforts in targeting relevant contacts rather than reaching out too widely. Selective and consistent visibility brings greater results.

Another way to build greater visibility is to dedicate greater resources to digital media. The most obvious benefit of social media is the platform it represents for PEIs to reach out to wide audiences in real time, and to build influence through disseminating knowledge, promoting their achievements and communicating their demands.

Identify the needs of industry and develop joint value propositions

PEIs recognise that they have much to gain by collaborating with industry to advance the profession, yet our research found that links with industry remain limited. Often, top executives, whether on the PEI side or on the private sector side, devote more time to screening potential partners in financial terms than through the lens of mutual learning and improvement. There is an opportunity for PEIs to dedicate more effort to identifying and articulating substantial value propositions when approaching new partners.

To do so, PEIs should outline their unique selling points for a potential partner, and then identify the unique added value of the potential partner, before finally identifying areas of joint value for both sides. Examples of areas of joint value can be found in the below table.

Examples of joint value propositions for PEI-industry partnerships (building on M.Chanakira's recommendations[14])

Sharing expertise for competitive edge

From an industry perspective, a key incentive is the acquisition of knowledge with an academic base, which can then be transformed into production, and consequently provide industry with a competitive edge.

Prestige and branding

Partnership between PEIs and private companies can bring prestige to both parties, particularly considering PEIs' direct connection with government and academic institutions.

Accessing key networks

One aspect of partnering with PEIs that is a clear added value is the existing connection and relationship with government. Conversely, PEIs' partnerships with reputable multinational companies and their ability to leverage industry connections can promote their own image and visibility.

Financial benefits

PEIs can receive significant funding and strengthen their academic brand and operational capacity. Private companies' affiliation with PEIs can create long-term financial benefits through promoting corporate social responsibility, as well as leveraging a connection to academic expertise and engineers themselves.

Workforce development and human resource capacity

A potential motive for partnerships between industry and PEIs is the development of employees, whereby PEIs and their academic connections offer industry employees skills for fundamental research, while industry brings more practical and hands-on opportunities to PEI members to learn on the job. Furthermore, PEI members' desire for industry attachment can increase the learning capacity of the organisation and develop the firm's human capital.

Even when partnerships are financially or commercially motivated, PEIs can add value through avenues such as:

- **Building a mutual service consortium** where PEIs and private organisations pool their resources to gain a benefit that would otherwise be expensive to acquire alone (for example, access to a piece of advanced technology).
- **Joint ventures** where organisations pursue an opportunity that requires the mixed expertise of the parties involved (for example, technological expertise versus market access).
- **Value chain partnerships** where PEIs and multiple companies (or strategic players) work together to meet market demands related to an engineering product or service. In this way, different organisations with complementary skills can link their capabilities to create value for users, customers, and trainees. This is the most common relationship among PEIs. Commitments in these relationships tend to be high, and partners tend to develop joint activities in many functions. Operations often overlap, and therefore the relationship creates substantial change within each partner's organisation.

14 A Zimbabwe scholar, M. Chanakira, has developed recommendations for building public-private partnerships between academia and the industry, which are directly relevant for enhancing PEI-industry relationships.

Expand and strengthen collaboration for more effective policy influencing

There is still fragmentation among engineering and STEM education bodies, especially in countries such as South Africa and Zimbabwe. PEIs should continue to join forces with other PEIs, including at the international level. This is particularly critical for those PEIs representing disciplines that are considered 'more minor'. Moreover, PEIs less actively collaborate with smaller or specialised organisations despite the potential benefit this could have for them. There is an opportunity for PEIs to open up their doors and join forces with a wider range of organisations to gain more clout in their interactions with policymakers.

Smaller STEM organisations may be able to provide thematic expertise and credentials that PEIs are lacking, giving them more credibility when approaching policymakers. Smaller organisations may also be able to contribute advisory and operational support to PEIs where internal capacity is lacking, such as in managing digital media, online visibility and social media analytics.

Finally, PEIs have a lot to gain from engaging more actively with supranational bodies, such as the Federation of African Engineering Organisations (FAEO), to represent their interests and take better advantage of the support they offer. In the same vein, PEIs have a lot to gain from improving communications with other international PEIs to gain insights into how they tackle similar policy issues and learn from best practices.

Expand monitoring and evaluation efforts to gain greater clout

PEIs would benefit from expanding monitoring and evaluation efforts to better measure and evidence the impact of the initiatives they lead. It would be valuable, for example, to collect data on the longer-term benefits accrued by graduate engineers participating in PEI-led placement schemes. Data is vital for demonstrating impact, and in turn, for convincing potential partners to support, fund, or upscale successful projects.

Moreover, setting up monitoring and evaluation systems can help PEIs adapt and learn from past experiences, including through improved planning, resource allocation and service delivery, as well as demonstration of results as part of accountability to key stakeholders. Greater monitoring and evaluation would support PEIs in allocating scarce resources in the most cost-effective manner, and help monitor the performance of PEIs' partnerships, ensuring they continue to deliver benefits.

Using digital media and analytics to influence policy

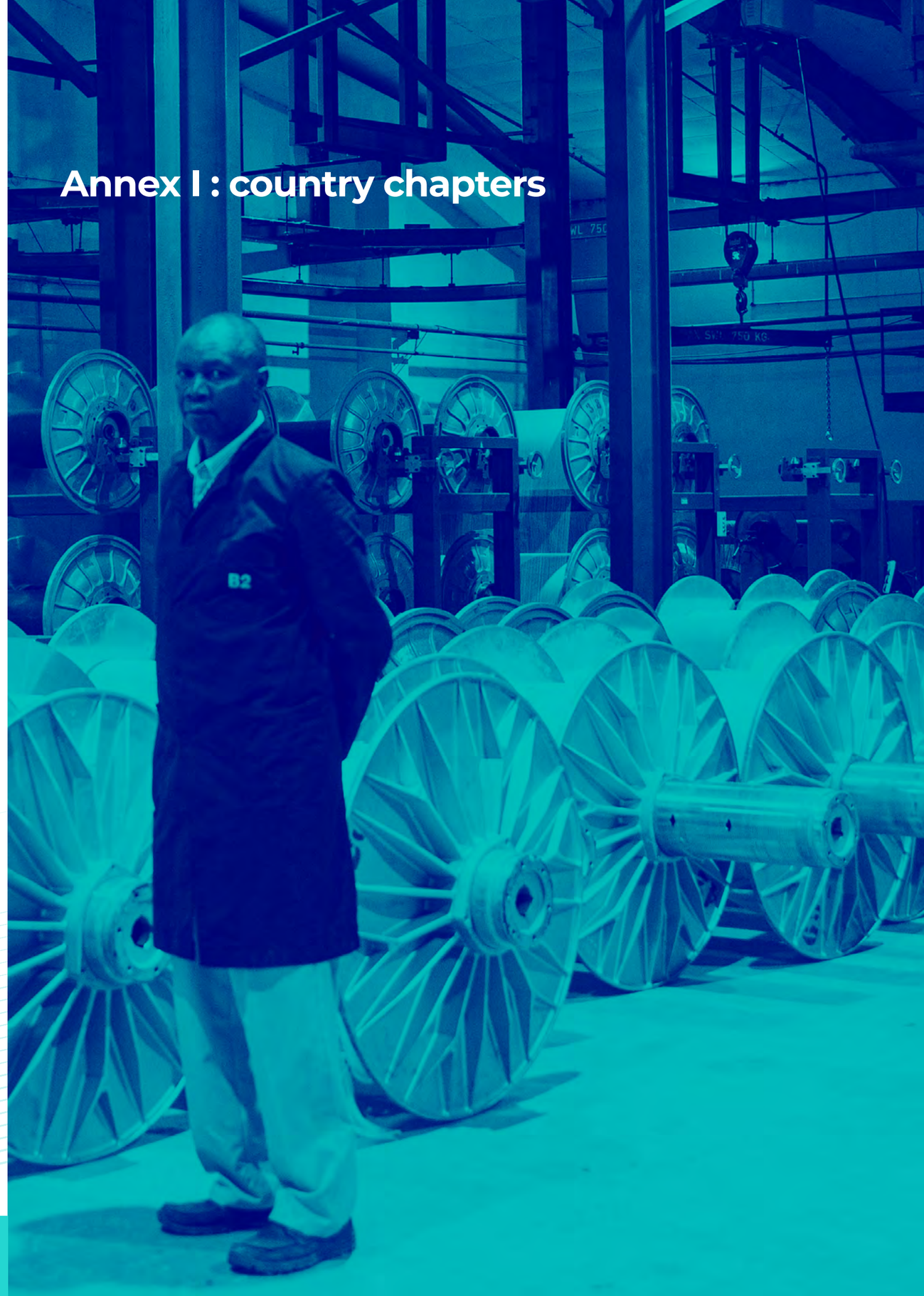
One way in which PEIs can improve their thought leadership is by dedicating more attention and resources to the increasingly relevant field of digital media and analytics. Social media networks have the potential to catalyse policy action and social change, as they can provide real-time evidence for policymaking and decision-making. Social media content and location information, for example, can help inform where to deploy resources or disseminate public messaging. Similarly, network analysis of 'friend' connections or other behavioural data can provide insight into how effectively recipients (including hard-to-reach groups) are accessing certain services or information. This form of data collection could complement existing research undertaken by PEIs, informing the roll-out of a more robust national Infrastructure Report Card, for example.

Better leverage the media and social media

As a minimum, PEIs should update their websites and social media platforms consistently with the latest news, promotional offers, webinars, and online events. To establish greater technical credibility among their members, the government and industry, PEIs should tailor their messaging to their target audiences and 'sell' the notion that they are a central actor in providing cutting-edge information through publications, technical blogs/papers, policy briefs, and high-profile knowledge exchange.

Furthermore, there is value in creating partnerships with a variety of different stakeholders, both domestically and internationally. Media coverage from such partnerships usually exposes a new audience to the work that PEIs are doing.

Annex I : country chapters



6.0 Nigeria

6.1 National PEIs' relations with policymakers and supranational governance bodies

PEIs in Nigeria recognise the importance of public partnerships for influencing policy, and have fostered links with government, regional and international bodies with relevant ties to the engineering profession. PEIs' relations with the government are not as strong as their engagement with supranational bodies and regional initiatives. However, there are promising examples of planned and existing relationships that signify **good visibility of PEIs during the policymaking process**. For further details, see the boxes below.

NSE's efforts to champion local engineering innovation projects

The NSE has been raising awareness of the engineering profession's contribution to local economic development by championing local innovation projects and urging the government to support local professionals that drive innovation. NSE's Ikeja branch, for example, held a week-long innovative and creative fair showcasing products made from locally available materials that address environmental challenges in health, agriculture, social media, and solar energy. According to the NSE, these efforts have contributed to President Muhamadu Buhari signing an executive order (Executive Order 5) on 5 February 2018 to improve local content in public procurement with science, engineering and technology components.

Forging Africa's Future Mechanical Engineers

NIMechE is working with the Industrial Training Fund, the government agency for building the capacity of youths in Nigeria, to deliver capacity building to new graduates through FAFME project (described in Table 1.1).

Throughout the course of this programme, young undergraduate- and graduate-level engineers are trained with skills, technical knowledge, and career guidance for professional and business excellence. The initiative began as a three-month intensive training of 100 mechanical engineers on 3 November 2020. FAFME has a number of activities in its programme, including establishing technology hubs, boot camps, innovation competitions, entrepreneurship workshops, and startup funding.

Engineering for Change

The Nigerian Institute of Electrical and Electronic Engineers (NIEEE) and the Nigerian Ministry of Power collaborated to organise the policy programme Engineering for Change. Engineering for Change is a knowledge organisation, the aim of which is to find solutions to unemployment in Nigerian engineering caused by the fact that many manufacturing and procurement activities in the industry are conducted abroad.

Regarding **collaboration with non-government stakeholders**, PEIs have established links with regional and international organisations across multiple sectors. NIMechE, the Mechanical Division of NSE, has implemented a number of partnerships, which focus on longer-term efforts to find opportunities for PEI members to attend engineering events abroad. An overview of key examples can be found in the table below.

Table 1.1: NIMechE's key supranational links

Organisation	Rationale	Nature of collaboration
Institution of Mechanical Engineers – UK (IMechE–UK)	Deepening professional relationships	As part of its efforts to deepen the professional relationship with IMechE–UK, NIMechE has approved the following actions: • To use NIMechE's National Secretariat as IMechE's desk office in Nigeria. • To provide a slot for IMechE representation in the NIMechE National Council. • To nominate a NIMechE representative to serve on the IMechE–Nigeria Board. • To link up NIMechE's library to IMechE's international library services to grant Nigerian mechanical engineers access to IMechE's resources. • To encourage members to take up membership with IMechE–UK and vice versa.
Engineering Forum of Nigerians – UK (EFN–UK)	Promoting technical and manpower development	During the EFN-UK, which was held in February 2019, NIMechE's National Chair approved a partnership on behalf of COREN to support the following activities: • Facilitating technical training/seminars in the UK and Nigeria, and technical visits to the UK engineering power houses. • Developing the technical and human capacity of mechanical engineering students, craftspeople, technicians, and young engineers through internships, training, research, and workshops to boost the capacities of indigenous mechanical engineers. • Promoting, encouraging, and supporting the development of engineering skills among young people in Nigeria and the UK. • Facilitating sponsorship of conferences, gender-based skill training, and institution-based research activities.
International Association for the Exchange of Students for Technical Experience (IAESTE)	Promoting strategic partnerships in educational and industrial sectors	NIMechE advocated for strategic partnerships with IAESTE, PEIs, and other critical stakeholders in a presentation titled 'Towards a strategic partnership of PEIs, IAESTE, employers, governments, and universities in Nigeria' at the Global IAESTE Forum. The Forum was part of the 72nd IAESTE Annual Conference, which took place in January 2019 in Limassol, Cyprus.

Organisation	Rationale	Nature of collaboration
United Nations Industrial Development Organization (UNIDO)	Partnership to accelerate industrialisation and reduce poverty	UNIDO and NIMechE are collaborating to address the myriad of challenges confronting Nigerian mechanical engineers, specifically on programmes that are aligned with the new Country Programme 2018–2022. The programme aims to support the Nigerian government's efforts to accelerate sustainable industrialisation for economic growth and poverty reduction. NIMechE anticipates that this will open training opportunities for technical and human capacity development of its members, and enhance the employability of young mechanical engineering graduates.
Engineers Against Poverty (EAP), UK	Partnership to promote capacity-building opportunities focused on poverty reduction	As a strategic partner of NIMechE, EAP has played a very important role in training NIMechE members in engineering project monitoring and evaluation. EAP also assisted NIMechE in developing a gender and diversity policy document – an endeavour that makes NIMechE the first Nigerian PEI with a policy document to promote inclusion and manage diversity challenges across the ranks of its membership.
Royal Academy of Engineering, UK	Seizing new project and learning opportunities with existing partners	NIMechE is further collaborating with the Academy on the FAFME project, launched in December 2019. Some key activities include: • Mentorship Boot Camp (including the NIMechE Internship and Mentorship Platform, the aim of which is to reduce the spread of the COVID-19 pandemic and democratise professional engineering training). • Goal-setting master classes for young mechanical engineering students and graduates, public lectures, panel sessions, and award presentations to young mechanical engineering leaders in Africa on the theme 'Youth-led innovation and sustainable development, and design and creativity competitions'. • Virtual learning events, such as the 33rd International Conference/AGM on 21 September 2020, a one-day masterclass on project management and control for young mechanical engineering graduates. • FAFME further proposes to organise a project monitoring, evaluation, accountability and learning webinar, facilitated by EAP, for NIMechE National and Chapter leadership.

Similarly, APWEN has seen **increasing interest in partnership from international bodies.** The Association has collaborated with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Global Alliance in Science and Engineering for Diversifying the Workforce, for example by contributing to conference sessions and roundtables. Furthermore, APWEN participated in the International Conference of Women Engineers and Scientists and the World Engineers Convention. APWEN also **has a MOU with the Society for Women Engineers,** and collaborates with both Women in Engineering and the WFEO.

A key challenge highlighted by PEIs is that a lack of recognition of Nigerian engineers among government stakeholders has **stifled opportunities for meaningful dialogue.** The Nigerian Academy of Engineering (NAE) does hold a strategic partnership with the Federal Ministry of Science and Technology for the promotion of science, engineering, technology, and innovation. It also seeks to work closely with the ministry and its parastatal organisations to **promote research and the application of research findings**[15]**.**

In practice, however, engagement opportunities in policymaking are limited, and policy documents related to engineering in Nigeria do not always sufficiently reflect the priorities of engineering professionals. While this is partly because of the (inadvertent) exclusion of engineers in policymaking circles, it also may be due to engineers' lack of broader public policy knowledge, or know-how to 'sell' policy change. Furthermore, with the exception of the Council for the Regulation of Engineering in Nigeria (COREN), most PEIs rarely receive any public financial support. This stifles their ability to invest in more strategic activities outside the realm of capacity building and other priority objectives.

6.2 PEIs' relations with industry

Nigerian PEIs recognise that the success of engineering as a profession, including the professional development of young engineers and opportunities for short- and long-term employment, are greatly advanced through collaboration and partnership with industry. There are a number of initiatives in Nigeria that aim to improve collaboration to solve engineering challenges and facilitate the progression of engineering graduates into engineering careers.

NIEEE ran the project Hope Initiative for Africa, sponsored by IEEE's global headquarters. The project provided a platform for young members to be trained in building solar lamps with local materials for the benefit of internally displaced people camps in Nigeria. The project was launched in 2018 in partnership with Solar Sister, a charity that invests in women's solar power projects in off-grid communities. The project is ongoing but no longer receives support from IEEE. As a result, NIEEE is soliciting support from various organisations to sustain it. NIEEE also has a three- to five-year plan to set up training labs across the country.

Another example is NIMechE's Internship and Mentorship Platform[16] – a web-based application for collecting, collating, accessing and managing mechanical engineering information in Nigeria. The app is particularly successful because of NIMechE's existing links with engineering companies.

The app was launched in July 2020 after FAFMEs' successful Mentor Bootcamp. It provides a centralised information platform for internship and job opportunities, connecting students with potential mentors. NIMechE noted that the app is the "first of its kind" in Africa, and it is designed to equip young mechanical engineers and students with applied skills in the engineering jobs market. Over the course of time, the platform will provide opportunities for virtual meetings, chat rooms, networking with industry players, and other value-added services to further promote professional development opportunities.

At the app's launch ceremony, the National Chair of NIMechE, Eng. Professor Mohammed Ndaliman, reiterated that the application seeks to close the skills gap and supplement theoretical knowledge. He further added that it aims to provide technological leadership to graduates, who may otherwise struggle to fit into industry roles without exposure to company culture.

Prior to the launch of the application, Eng. Dr Robinson I. Ejilah gave a press briefing to present the project. Dr Ejilah is the Chair of the NIMechE– FAFME Project Implementation Committee and Immediate Former National Chair of NIMechE.

15 **'NAE spotlight',** NAE, undated.

16 **www.nimecheim.com**

The app has received funding and support from various organisations, including the Academy (GCRF Africa Catalyst, Phase 3.0); IAESTE; the Tony Elumelu Foundation; the Energy Training Centre; the Industrial Training Fund; IMechE–UK, EFN–UK; Balbus UK Limited; Laspotech; the African Engineering Education Association; and other distinguished Nigerian engineers and engineering organisations. Similarly, NIMechE has sought to establish visibility and strategic business opportunities through global conferences, as exemplified in the box below.

NIMechE's efforts to build links with international businesses

NIMechE has been improving relations with partners overseas through international events. In September 2019, a business-to-business conference on HVACR was organised by Elan EXPO and the Turkish Export Society. The event **brought together manufacturers and the Nigerian professional engineering and business communities.**

Recognising that Turkey is a country with a huge engineering market and, thus, potential to invest in African engineering, NIMechE's National Chair presented a number of recommendations to 16 Turkish industrial technology companies. The Chair **encouraged the companies to set up factories and assembly plants in Nigeria** to enhance service provision and employment, and promote local content. The Chair also presented innovations to improve the efficiency of HVACR facilities with capacity for low-cost cooling and top energy saving to tackle the challenges of high energy cost and frequent power outages.

More generally, PEIs have made public **appeals for greater collaboration with the private sector** in the areas of transportation, telecommunication, power, aviation, hospitality, health, and environment. For example, during the virtual conference of the Institute of Electrical and Electronics Engineers (IEEE) in October 2020, COREN President Ali Rabiu appealed for business partnerships with firms operating in digital technologies related to robotics, machine learning, the internet of things, artificial intelligence, solar power, battery storage, wind power, electrified vehicles, smart buildings, and microgrids[17]. The premise of this appeal was to **encourage private sector support in supervising project sites** across the country to improve the quality of infrastructure.

17 'COREN seeks public, private sector support for quality infrastructure', Vanguard, 28 October 2020.

6.3 PEIs' relations with academia

Relationships between PEIs and universities are relatively well established in Nigeria, creating opportunities for real-world application of what is learned in the classroom. PEIs note, however, that there is often a **mismatch between academic knowledge and the technical and practical needs of the industry**. This puts young graduates at a disadvantage when they first sit in interviews or enter the workplace. Bridging the gap between academia and industry has therefore been a key focus for national PEIs. Some PEIs have focused on improving the relevance of engineering education by working more closely with universities to create industry-tailored curricula. A key example by NSE is highlighted in the below box.

NSE's mission to develop industry-oriented curricula

NSE established links with universities and colleges as part of its mission to improve their curricula and make them more industry oriented. The process involved engaging 26 discipline-specific PEIs, and providing them with a tool to **identify the current gaps between industry and academia and how to bridge them**. As a result, discipline-specific PEIs, including APWEN, are now establishing connections with respected industry leaders and analysing university offers together.

In the longer term, NSE is seeking to organise industry retreats for young lecturers, which would have the potential to strengthen existing networks with PEIs, the academic world and the private sector.

NIMechE is also seeking opportunities for increased cooperation with universities by **involving academics in training events.** For example, in February 2020, NIMechE arranged a boot camp and workshop to train engineering professionals as mentors for the FAFME project. Mentors were selected from across the various NIMechE chapters in Nigeria, including academic institutions.

NIMechE also pursued a partnership with the Transportation Growth Initiative on mobility and access in African cities, which has facilitated greater engagement with academic research and development. This initiative focuses on transport research, human capacity development, promotion of best practices, and the networking of stakeholders in the transportation sector.

Furthermore, following a second round of funding from the Academy, NIMechE developed the **NIMechE Innovation Challenge 2.0 (NIC 2.0)** in partnership with EAP. NIC 2.0 was dedicated to building the capacity of mechanical engineering students in Nigeria and Ghana through targeted learning in engineering development and entrepreneurship. A key element of this project was that it focused on **internship development and the capacity building of mechanical engineering students** to provide innovative home-grown solutions in agriculture, healthcare and sanitation, education, and sustainable energy. NIC 2.0 was designed to support collaboration between academics and mechanical engineers, enable interns to gain practical experience in engineering, and develop their professional networks and employability. Academics themselves were able to support **high-quality research and evidence mapping** in the countries where grant funding had been administered, forming a clear evidence base with which to identify training needs and priorities.

As noted by former NIMechE Project Manager Osazoduwa Agbonenin, NIC 2.0 was improved on the basis of the monitoring and evaluation conducted for NIC 1.0. Mr Agbonenin added that "NIC 2.0 is set to implement some of the solutions during the second phase of this project by introducing entrepreneurship development, technical and vocational training, and life skills[18]". NIMechE has also been proactive in adapting group learning courses to make them virtual, spurred by the COVID-19 pandemic. A key example is ENGentrepreneur, outlined in the box overleaf.

18 'NSE, UK Academy to provide capacity building for 500 Nigerian Students', the Chronicle of Education, 12 February 2018.

NIMechE's virtual school and collaboration with 33 Nigerian universities

During COVID-19, NIMechE decided to move all activities delivered through its Academy-funded boot camp online, and created **ENGentrepreneur – a virtual school on engineering and entrepreneurship**. A key success factor for ENGentrepreneur was working with academics to agree on the focus of the online courses, and working directly with PEI members and students to identify skill gaps, as well as members' professional interests. The digital school team was coordinated by the NIMechE National Student Forum. Together, committee members identified areas where students need more training to become more employable. Other divisions of NSE will soon be able to upload their courses on the platform to increase the offer as well as collaboration between PEIs. The NIMechE National Secretariat opened a call for facilitators, while the NIMechE National Student Forum and the student branches that the PEI has in 33 Nigerian universities were involved in reaching out to potential participants.

NIMechE is also in the process of digitising its mentoring scheme. As a result, new mentors are joining from industry and academia, even from outside the country. The online nature of the scheme enables **easier, more frequent and flexible communication between mentors and mentees**. Because of its success, the scheme has received funding from various organisations, including: the Academy's Africa Catalyst programme; IAESTE; Tony Elumelu Foundation; Energy Training Centre; Industrial Training Fund; IMechE-UK; EFN-UK; Balbus; UK Limited; Laspotech and African Engineering Education Association. According to Osazoduwa Agbonenin, working with the right team and incorporating professionals' and students' feedback into the course design are the main success factors of the initiative.

According to the National Chair of NIMechE, **collaboration between stakeholders active in the engineering profession is improving** in general, in part because of the COVID-19 crisis. In September 2020, the NSE president and the executive director went to Kaduna State to discuss solutions to COVID-19 with representatives from Kaduna Polytechnic. The meeting aimed to facilitate collaboration between industry, academia and NSE members on research to determine which local materials could be used for the production of necessary medical equipment.

In general, interviewees reported **high levels of collaboration between public, private, non-governmental and university actors**. They all appear to be motivated by the same goal – overcoming the pandemic – and are guided by national policy. These kinds of collaborations are expected to be useful for cementing longer-term partnerships. While such links with academic bodies are a positive start, the relationship could be further deepened by PEIs to foster closer collaboration between industry and academia, including on graduate work experience and engineering curricula.

In general, universities are considered to be underfunded in Nigeria, and their equipment and approaches to teaching relatively outdated. PEIs have expressed a view that the curricula of Nigerian academic institutions may be perceived by firms as **inferior to those offered by institutions abroad**. There is also a perceived **lack of industry engagement with training and education**, including insufficient placements and internships. Therefore, PEIs such as NSE recognise that greater PEI involvement in curriculum development and closer liaison with colleges and universities will help to align PEIs' extracurricular training opportunities with study schedules. One suggested solution is PEI representation on engineering faculty boards/steering groups.

6.4 PEIs and the media

PEIs in Nigeria are seeking to build social engagement and influence through online media. Digital media provides many ways to identify and maintain **direct and indirect communication between engineering stakeholders**, and to promote PEIs both as thought leaders and effective knowledge managers.

NAE, COREN, NSE, and APWEN have websites that are, for the most part, regularly updated. Most of them include house newsletters, news/blog updates, materials from past conferences or learning events, details for upcoming events, and guidance and practical information about their scope and membership process.

Facebook is commonly used by Nigerian PEIs for promoting webinars and other online workshops hosted by PEIs and universities. NSE's Facebook page, which has almost 28,000 likes, is a successful platform that sees regular engagement from students and university representatives, qualified engineers operating in both the public and private sector, and other PEIs.

For example, the recent NSE National Engineering Conference posted a video on Facebook on 17 November 2020, which received 44 shares and approximately 180 likes[19]. Furthermore, as part of their efforts to promote ENGentrepreneur, NSE and NIMechE recently implemented a **multipronged marketing campaign using Facebook and Google Ads.**

Both NSE and NIMechE also promote the wider interests of the engineering profession and academia by posting regular updates about theoretical information, local engineering initiatives, and recruitment opportunities. For example, in January 2021, NIMechE uploaded a post with credit to Stony Brook University's College of Engineering and Applied Science, titled 'What type of person makes a good mechanical engineer?'. It also shared a request for feedback on the advance of electric cars.

NSE branches in different Nigerian states, as well as in London and Manchester (UK) and Portland (USA), have also **organised webinars** on issues such as entrepreneurship, leadership, how to engage with members and other stakeholders via digital platforms, and the post-COVID-19 green revolution. Lectures were organised every week, and included a presentation on infrastructure development by the Infrastructure Commission on Public–Private Partnerships.

APWEN has also been **proactive in fostering cross-stakeholder engagement**, using Facebook, YouTube, and its own website for dissemination and promotion[20].

For example, as part of the 'Invent It, Build It' programme and the International Women in Engineering Day (23 June), APWEN held three key activities:

- A press conference at the National Engineering Centre in Lagos, where the discussion focused on the progress of women in engineering.
- A webinar on the role of women in shaping the world, which gathered over 300 participants, including high-level representatives of NSE and COREN, Members of Parliament, and university champions.
- A panellist discussion on the need for diversity and inclusion in engineering, which was attended by representatives from the University of the West of Scotland, WFEO and NIMechE, among others. APWEN members from all 24 chapters across the 36 Nigerian states joined the event. Following the success of this event, APWEN held its annual conference on the dynamics of engineering education for sustainable economic development on 23 September 2020.

The COVID-19 crisis has provided unique opportunities to improve the online presence of Nigerian PEIs, and increase visibility and reach across a wider set of stakeholders. This is beneficial in terms of access to learning and promoting the achievements of PEIs. However, it is apparent that **media could be used more proactively by PEIs**, or indeed that resources could be dedicated to managing social media accounts and strategies.

The chair of the NIMechE–FAFME Implementation Board highlighted that, as a minimum, **PEIs should update their websites and social media platforms regularly** with the latest news, promotional offers, webinars, and online events. However, to establish greater technical credibility among their members, the government and industry, PEIs should tailor their messaging to their target audiences. It is important that PEIs 'sell' the notion that they are a central actor in providing cutting-edge information through publications, technical blogs/papers, policy briefs and high-profile knowledge exchange.

19 The NSE Facebook page.

20 https://www.youtube.com/watch?v=edXkVOoJOtQ; https://www.facebook.com/apwenph/

6.5 Appendix: overview of key engineering stakeholders and priorities in the country

Key stakeholders

In Nigeria, the main PEIs are the NAE, the NSE, NIEEE and APWEN.

NAE is a non-profit and non-governmental institution focused on technological growth and innovation. Its priority is to promote the quality of engineering education and the general advancement of engineering science, practice, and technology in wider society.

NSE's goal is to promote engineering education, research, and practices according to professional and ethical standards and across discipline-specific PEIs. The focus of **APWEN** is to promote the role of women in the engineering profession.

The **top universities for studying engineering** in Nigeria are the Federal University of Technology Akure, the Federal University of Technology Owerri, the University of Ilorin, and the University of Lagos.

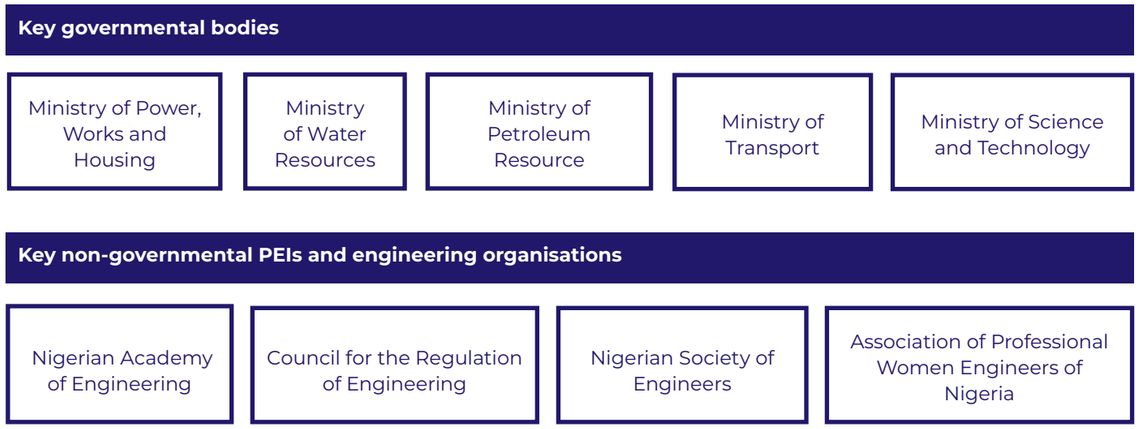
The key regulatory PEI is the COREN. COREN's key objective is to regulate the practice of engineering in Nigeria, established by Decree 55 of 1970 and amended by Decree 27 of 1992, now the Engineers (Registration, etc.) Act, CAP E11 of 2004. NSE liaises with COREN on all major issues relating to engineering, including engineering regulation monitoring, mandatory CPD, and remuneration for engineers.

NIEEE was established as a group of COREN-registered electrical engineers, with engineering chapters in 28 cities across the country. The organisation seeks to promote professional competence and excellence among members through innovative and sustainable solutions to challenging engineering problems by deploying efficient technologies and systems.

At **government level**, the ministries that are most relevant to engineering works are the Ministry of Power, Works and Housing, the Ministry of Water Resources, the Ministry of Transport, the Ministry of Science and Technology, and the Ministry of Petroleum Resources, among others. Other governmental bodies that are also relevant engineering stakeholders include: the Department of Petroleum Resources (the Petroleum Regulatory Agency); the Nigerian National Petroleum Corporation; the National Solar Power Authority; and the Nigeria Communications Commission.

Within the **private sector**, there are a number of big players operating in the engineering space in Nigeria (most notably in oil, gas, construction and electrical engineering) with existing links to PEIs. These include Julius Berger Nigeria Plc, Reynolds Construction, Setraco Nigeria, China Civil Engineering Construction Corp, and Costain West Africa.

Figure 6.2: Overview of the key engineering stakeholders in Nigeria



National priorities for engineering

There are a wide range of laws, legislations and subsidiary instruments in Nigeria relevant to the engineering industry, such as: Nigerian Constitution (1999); National Agricultural Policy (1988); Petroleum Act; Associated Gas Reinjection Act; Electric Power Corporation Act; Nigerian Mining Corporation; Water Resources Act; Oil Pipelines Act; Nigeria Liquified Natural Gas Act; International Convention for the Prevention of Pollution from Ships (1973); and the 1978 Protocol (Ratification and Enforcement) Act (No. 15 of 2007)[21].

Engineering in Nigeria developed rapidly after the country's independence in 1960 to advance numerous projects in road and railroad construction, water supply, mining, dredging, housing, electrical and mechanical engineering. In 2018, the Nigerian government passed the Engineers (Amendment) Act to increase COREN's ability to ensure compliance and enhance regulation of engineering practice against international standards. The amended Act also sought to focus efforts on capacity building of local engineers to increase local participation in the Nigerian construction industry.

21 'Government policies and engineers' roles in facilitating Nigeria's transition to circular economy', Dunmade, I.S. et al, Journal of Physics: Conference Series, 2019.

7.0 Sierra Leone

7.1 National PEIs' relations with policymakers and supranational governance bodies

Since SLIE was set up by a memorandum and articles of association and, subsequently, established as a statutory body, it has been **overseen by the Ministry of Work**. SLIE therefore enjoys close relationships with relevant ministries and high-level decision-makers. In 2019, for instance, representatives from SLIE met with President Bio to update him on their activities and share their priorities, including the desired amendments to the 1990 Act[22].

However, the hierarchical nature of this relationship has constrained the ability of SLIE to be critical of the government's actions, or to push more aggressively for reforms that it perceives as paramount for the profession's success moving forwards. This has led to frustrations within the organisation, where staff report that interactions with policymakers are always a 'roll of the dice'. While more government representatives are beginning to see the value of engineering with regard to achieving structural transformation and economic development, there is still a **significant portion who refuse to participate in open dialogues** with the engineering profession. SLIE has yet to achieve a cohesive understanding of what it is that engineers offer for development and progress within the government.

There are two more issues that have significantly hindered SLIE (and engineering more widely) in influencing policymakers:

- **The short-term nature of politics in Sierra Leone:** As a result of policymakers being frequently replaced, they often fail to enact long-term policies. Consequently, when they come to be replaced, all progress that has been made is essentially reset, and strategic priorities are rapidly changed.

- **Corruption within government departments:** The corruption in government departments results in policymakers prioritising benefits and development within their own constituencies over a coherent strategy that ensures resources are allocated efficiently at the national level.

As a result, **SLIE's impact on national policy remains limited**, and engineers in Sierra Leone continue to feel underrepresented and undervalued. They regard policy as being formulated in isolation of technical expertise, by politicians who have a limited understanding of the potential of engineering. For example, in the mining sector a number of poorly formulated agreements (often with foreign companies)[23] exist, with little technical inputs from engineering professionals[24]. For details of the consequences of the lack of engineering inputs into the regulation of the sector, see the box below.

The negative consequences of the lack of engineering inputs in regulating the mining sector

The mining sector continues to operate at far below its potential capacity, particularly in the extraction of iron ore, for which it has substantial deposits[25]. While private sector firms are sometimes commissioned to conduct feasibility studies or help with project design, there are a **lack of opportunities for involvement** during the initial policy design phase. Thus, while there is some scope for improving the effectiveness of projects, deciding which projects are presented to the sector is done without their consultation (and their technical expertise)[26].

Furthermore, when dialogues are opened up, it is reported that **there is limited follow-through**. For example, when SLIE met with President Bio in 2019 (as referenced above), he stated that "the [1990] Act itself must be made current, [...] we will quickly move through the stages of governance to empower you and bring it up to date." However, two years on, the Act remains unchanged[27].

22 'Sierra Leone Institution of Engineers and Professional Engineers Registration Council Pay Courtesy Call on President Julius Maada Bio', State House Media and Communications Unit, 31 January 2019.

23 'No pot of gold for locals as China mines Sierra Leone', Reuters, 22 August 2019.

24 'Political Economy of Extractives Governance in Sierra Leone' World Bank, July 2013.

25 Ibid.

26 'Political Economy of Extractives Governance in Sierra Leone' World Bank, July 2013.

27 'Sierra Leone Institution of Engineers and Professional Engineers Registration Council Pay Courtesy Call on President Julius Maada Bio', State House.

It is the Professional Engineers Registration Council (PERC's) primary mission to maintain internationally recognised standards of competence and commitment for the engineering profession in Sierra Leone, and to ensure that institutions and practitioners are sufficiently competent. However, without reforming the Act, PERC's Director claim they are ill-suited to meet this mission.

SLIE's struggle to push for a reform of the Professional Engineers Act

As of February 2021, SLIE's main priority is achieving amendments to the 1990 Professional Engineers Act, which is generally perceived as outdated and, subsequently, unable to adequately account for the interests of its members. For example, the Act fails to sufficiently define membership, meaning that the very understanding of who can be classified as a professional engineer is both ambiguous and lacking stature. Moreover, if an individual is found to be working as an engineer without registration, they are given an inconsequential fine of $10.

PERC has further called for amendments in relation to local involvement in engineering projects. It has argued that the revised Act should mandate between **10% and 15% local participation in all engineering projects** funded by donors and foreign companies. Countries such as Ghana and Nigeria have enacted such quotas to improve the local ownership of projects and provide increased employment opportunities for domestic engineers. PERC has presented a plan for reform on which it received positive feedback from officials. However, the Act remains unchanged to date.

Nonetheless, SLIE is dedicated to ensuring that long-term government strategies are devised, and certain successes are achieved. SLIE has worked successfully with the Minister of Energy, Henry Macauley, on projects such as ensuring that **young engineering graduates from Fourah Bay College have access to capacity training**[28].

SLIE's collaboration with the Ministry of Energy for engineering graduates' capacity building

SLIE designed and carried out a project in collaboration with the Royal Academy of Engineering, with funding from GCRF. The aim of the project is to improve the soft skills of engineering graduates in Sierra Leone. In the pilot phase training was provided to 20 graduates in areas such as computer skills, project management, and CV writing. The project is currently ongoing and has now provided training to more than 50 graduates[29]. **SLIE was also involved in substantial consultancy** during the preparation of the National Energy Efficiency Action Plan, which is in place until 2030[30].

SLIE's **relationships with supranational bodies remain underdeveloped.** While the institution has representation at the FAEO annual conference, other interactions are reported to be limited.

According to SLIE, FAEO does not sufficiently engage with the challenges facing engineering in Sierra Leone. SLIE believes that FAEO could do more to **encourage further collaboration and information-sharing between PEIs** from different countries, and to produce overarching guiding principles for regulations within the engineering profession. SLIE also believes that a more **unified approach to overcoming sectoral challenges** would be preferable, and this is something that FAEO (and particularly the FAEO West Africa branch) could be responsible for achieving. SLIE acknowledges, however, that funding limits the scope of what can be achieved by FAEO.

28 'Capacity training for young engineering graduates', Concord Times, 16 March 2017.

29 Phase 2 projects', Royal Academy of Engineering, undated.

30 National Energy Efficiency Action Plan, Ministry of Energy, 30 July 2015.

Moreover, although Sierra Leone is a member country of the WFEO, which aims to unite multidisciplinary engineering associations across the world and foster sustainable development and poverty alleviation within its member nations, evidence of participation or collaboration between engineers in Sierra Leone and WFEO is extremely limited. Likewise, SLIE's **relationship with the African Union is minimal.**

7.2 PEIs' relations with industry

Overall, SLIE's primary collaboration with the private sector revolves around **promoting the insertion of young engineering graduates into the workforce.** In recent years, SLIE has provided mentoring and training to students in an effort to better prepare them for the labour market and ensure that talent is retained within the profession.

It has also pushed for an **increase in work experience opportunities**, both domestically and internationally. For example, SLIE has partnered with Easy Solar to provide internship placements in Sierra Leone, as well as with Engineers for Change to provide international opportunities, so that students and graduates can develop their practical skills.

However, while internship opportunities may provide students with valuable practical experience, students and graduates are not always equipped with the skills and experience necessary to provide positive contributions to the firms with which they are placed. This is due to the limitations of academia in Sierra Leone (discussed in more depth below).

Opportunities for dialogue between the private sector and government representatives are limited. SLIE represents an opportunity to either facilitate discussions or act as a mediator to articulate both the challenges and the opportunities identified by private sector actors to the government. Thus, it is vital that private sector actors feel represented by SLIE. To achieve this, **SLIE intends to improve dialogue with the private sector**, so that it can better understand how and when to intervene.

For example, SLIE would like to organise sessions for different stakeholder groups from the engineering profession to come together and **share their technical expertise to help one another overcome challenges.** In this context, SLIE has strived to lobby the government on a longstanding issue of importance to the private sector: tightening requirements on registering as a professional engineer.

SLIE has limited links with international private sector organisations. However, it recognises that such relationships could introduce new opportunities for engineers in Sierra Leone, as well as facilitate the diffusion of knowledge and best practices across borders.

SLIE's pledge to make engineering registration requirements more stringent

Private sector actors have expressed the need to tighten restrictions on registering as a professional engineer and increasing the minimum baseline required to achieve registration. This includes requiring that all those who wish to maintain their membership pass periodic examinations to ensure that they stay abreast with current trends and knowledge within the sector.

Many private sector organisations have turned to developing their own standards for employees, based on standards from countries such as the UK and the US where many Sierra Leonean engineers study in order to receive more rigorous teaching. Raising minimum standards would improve the credibility of industry, since accreditation would represent a more substantial set of skills and experiences. SLIE has been proposing such changes to the government for a number of years.

7.3 PEIs' relations with academia

SLIE has a very close relationship with academia – particularly Fourah Bay College – in part because several members of PERC work in academia. However, as with the issues identified with private sector engagement, SLIE considers that **reform is necessary within academia.** The accreditation of degree-level courses needs to be stricter and to account for the progress that has been made within academia since the Act was passed.

Currently, the engineering courses offered in Sierra Leone's universities are **narrowly specialised** and only provide students with knowledge of a single discipline, meaning that graduates are not well-rounded, and are only qualified for a small portion of jobs within the profession.

Another key challenge is that the majority of lecturers in Sierra Leone only work part-time, and have other jobs alongside teaching, such as working for engineering consultancy firms. Therefore, their engagement with such types of reform tends to be low because they only have limited time for engaging in the initiatives. This means progress is slow. The reason that so many lecturers work part-time is because funding opportunities in academia are extremely limited. Thus, staff training is kept to a minimum, there is limited research infrastructure, and there is a lack of an effective education quality management system. Consequently, teaching staff are **less able to align the content of their courses with the needs of the labour market,** and as a consequence, companies are reluctant to hire fresh graduates.

In a case study of Fourah Bay College conducted by SLIE in collaboration with the Royal Academy of Engineering, it was revealed that the internet connection was weak, the books in the library were outdated, and there were very few IT software packages available for students[31]. SLIE is currently attempting to tackle this issue through its participation in the project Assuring Quality Higher Education in Sierra Leone, in collaboration with the FCDO[32].

Since 2018, SLIE has also worked alongside the Royal Academy of Engineering to provide seminars on employability and competitiveness in the labour market at Fourah Bay College.

SLIE's joint efforts with academia on assuring quality higher education in Sierra Leone

SLIE is partnering with Sierra Leone universities as part of the FCDO-funded SPHEIR project. The aim of the project is to facilitate learning with UK universities, including King's College London, to understand how best to design curricula, and to identify examples of best practice that can be applied to Sierra Leone. During the COVID-19 pandemic, for example, the project shared methods for ensuring continued access to students, such as the use of WhatsApp for communication between students and academic staff[33]. The project has also created the Skills Development Network, which brings together employers from Sierra Leone, representatives from academia, and the Sierra Leone Tertiary Education Commission to tailor curricula to employers' needs[34].

7.4 PEIs and the media

Press coverage is a vital tool for creating a spotlight for engineering priorities, as well as the work that SLIE is doing and how this is contributing to developmental progress. Good media coverage can help the organisation to attract buy-in from the government, funders, and the wider public (such as encouraging young people to study engineering).

SLIE has a good relationship with the media and major news outlets. For example, the *Sierra Leone Telegraph* regularly reports on current affairs pertaining to the engineering industry.

SLIE participates in several **activities to increase its media coverage:**

- SLIE **creates partnerships with a variety of different stakeholders**, both domestically and internationally. Media coverage from such partnerships usually exposes a new audience to the work that SLIE is doing.
- SLIE **promotes its participation in current affairs.** For example, it has been active in Sierra Leone during the COVID-19 response since the outbreak began. Sierra Leone Women Engineers (SLWE) donated hand sanitisers, toiletries, and food items to those in need, while SLIE hosted a series of webinars on topics such as disaster management. SLIE also shared stories of how the engineering industry was mobilising to aid the response. For example, it wrote about how the Fomel Industry and National Industrialization Centre, which usually specialises in manufacturing agriculture-processing equipment, had turned its attention to manufacturing a portable freestanding hands-free faucet that is operated by stepping on pedals to access soap and water on demand[35]. In this way, SLIE **highlighted the importance of funding engineering innovations** for the social good.
- SLIE publishes an annual magazine, which details the progress that was made in the previous year, as well as its priorities moving forwards.

31 International Engineering Education Conference, SLIE, 24 September 2018.

32 'Assuring Quality Higher Education in Sierra Leone', SPHEIR website, undated.

33 'How a higher education reform partnership in Sierra Leone is adapting to COVID-19 restrictions', SPHEIR website, 24 July 2020.

34 'How can we help students develop the skills that employers and society really need? University-employer engagement in Sierra Leone', SPHEIR project, 15 December 2020.

35 'African solutions to the coronavirus crisis', BBC News, 22 May 2020.

Nevertheless, **SLIE does not have an active presence on social media**, with its most recent post coming from August 2020 on Twitter. While there have been occasions when SLIE posted multiple times in a month, it is very inconsistent – typically posting once per month or less.

SLIE acknowledges it could use its social media platforms more effectively (it currently has Facebook and Twitter pages) to promote news and events, and create a LinkedIn page to gain a wider professional reach. In addition, it has acknowledged that it could be more proactive and forthcoming in ensuring that the media report on relevant issues.

7.5 Appendix: overview of key engineering stakeholders and priorities in the country

Key stakeholders

SLIE is the only PEI in Sierra Leone. SLIE was founded in 1970 through a memorandum and articles of association, and in 1990 it became a statutory body, following the passing of the Professional Engineers Act. Under the Act, **PERC** was formed as a branch of SLIE. The aim of PERC was to maintain recognised standards for the engineering profession, and license and register engineering institutions and practitioners. As a result, to be officially recognised as a professional engineer in Sierra Leone, an individual must receive SLIE's approval.

SLIE is funded primarily by the fees that it collects from its members, of which there are now more than 1,200, as well as 150 student members. However, the number of paid staff remains extremely low, with the **majority of staff working on a volunteer basis.** For instance, elections are held every two years to elect representatives to work in PERC. These representatives come from a variety of channels, including academia and the private sector, but the positions are not paid. SLIE receives some funding from donor agencies and from organising training courses, but **it has not received funding from the government in the past 10 years.**

Nevertheless, SLIE has made strong progress towards ensuring that the **voices of underrepresented groups are heard**, and it has lobbied extensively for **inclusivity within the engineering profession**. The organisation has a Women's Chapter (SLWE), which participates in a variety of activities to improve gender inclusivity within the profession, such as mentoring female secondary students. In 2020, SLIE appointed Trudy Morgan as its first female president.

With respect to government bodies, PERC is supervised by the Ministry of Works. There are several other ministries within the government that relate to engineering, including the Ministry of Water Resources, and the Ministry of Mines and Minerals.

Furthermore, in 2018 the Directorate of Science, Technology and Innovation (DSTI) was founded to oversee and support the government in delivering the national development plan, with specific attention to the pillars of progress relating to science and technology. Upon DSTI's establishment, President Bio reiterated his belief that science and technology are "the bedrock for the development of any modern economy"[36].

A number of other engineering stakeholders in Sierra Leone exist within academia. Several universities, such as Eastern Polytechnic University, **have obtained accreditation from SLIE** for their degree-level engineering courses. However, the University of Sierra Leone is the only university with an engineering department (hosted within Fourah Bay College) and therefore produces the vast majority of Sierra Leone's engineering research and graduates.

With respect to the private sector, because of the small size of the engineering profession in Sierra Leone, **there are few large engineering firms.** The majority of private sector firms are small consultancies made up of teams of typically less than 10 employees. Engineering projects are frequently conducted by donor agencies who do not employ local workers, but instead outsource the work to international organisations. Moreover, **there are no domestic engineering NGOs operating in Sierra Leone**, but there are several international NGOs that conduct projects within the country, such as Engineers for Change and Engineers without Borders.

Figure 7.1: Key engineering stakeholders in Sierra Leone

National priorities for engineering

As engineering activities fall under a number of Sierra Leone's ministries, there are several strategic documents that identify engineering priorities within the country. For example, under the **National Development Plan 2019–2023**, the government outlines the need to improve water infrastructure systems in order to expand access to basic water services, which currently cover less than 40% of the population[37].

Regarding the priorities of specific ministries, the Ministry of Energy developed the **Electricity Sector Reform Roadmap (2017–2030)**, which describes the Ministry's role in improving access to electricity across Sierra Leone. Priorities include investments in generation capacity and capacity building. As part of the reforms, the Ministry led the Mano River Union electricity project, which has received more than $400 million in investments[38].

DSTI's current priorities relate to the use of rigorous scientific data to guide decision-making within other government departments. The aim is to achieve this through initiatives, such as the Green Cover project that uses satellite imagery to calculate forest green cover over the Western Area of Sierra Leone to visualise changes associated with the loss of forests and other environmental challenges[39].

36 'Seeding Innovation in Sierra Leone', Tony Blair Institute for Global Change, 20 July 2018.

37 'Sierra Leone's water minister Tengbe appeals for international help', Sierra Leone Telegraph, 27 June 2018.

38 'Sierra Leone awaits the arrival of Manor River Union electricity', Sierra Leone Telegraph, 26 May 2020.

39 Green Cover over Western Area using Satellite Imagery, DSTI, undated.

8.0 South Africa

8.1 National PEIs' relations with policymakers and supranational governance bodies

Relations between PEIs and policymakers

South African engineering institutions and PEIs interact **with a wide range of national government departments**, including trade and industry, science and technology, environmental affairs, energy, water and sanitation, rural development, agriculture, and communications. Some of the most active PEIs in South Africa include ECSA, the SAAE, and the Institute of Municipal Engineering of Southern Africa (IMESA). See the table below for some examples of links between PEIs and national government in South Africa.

Table 3.1: Examples of links between South African PEIs and national government

PEI	Key links with the national government
ECSA	• The Minister of Public Works is the custodian of the Engineering Profession Act, Act 46 of 2000 that established ECSA. • ECSA recommended to the Minister of Water and Sanitation an Approved Professional Person with at least three years' experience in dam engineering. • ECSA is mandated by the Department of Higher Education and Training to conduct accreditation visits to any educational institution that has a department, school, or faculty of engineering at least once during its term of office (four years). • ECSA has a MOU with the Department of Labour and the National Prosecution Authority, which assists in investigating improper conduct of registered people.
SAAE	Government-funded organisation (Department of Science and Innovation).
IMESA	Close ties with other local public bodies via its participation in strategic forums: the National Treasury, the Department of Cooperative Governance and Traditional Affairs, the SALGA, and the Municipal Infrastructure Support Agent.

Furthermore, several South African PEIs are well linked with international engineering organisations and supranational multilateral engineering bodies. See the table below.

Table 3.2: Examples of South African PEIs' international links

PEI	Key international links
ECSA	Member of three international education accords (the Washington Accord for Engineers, the Sydney Accord for Technologists, and the Dublin Accord for Technicians) and three international agreements (the International Professional Engineers Agreement, the International Engineering Technologist Agreement, and the Agreement for the International Engineering Technicians). To improve the dialogue between government and PEIs, WFEO creates forums that engage policymakers and PEIs at the national level. One example is the UNESCO African Engineering Week, which is co-hosted by the Department of Science and Technology, ECSA and the Central University of Technology. Other international stakeholders include accreditation boards and engineering institutions in Canada, Hong Kong, Japan, the UK, and the US.
SAAE, IMESA, CESA, The Institute of Electrical and Electronics Engineers South Africa Section (IEEE-SA)	These organisations pursue international links with peer organisations in Africa mainly through multilateral bodies: • In Africa: the International Federation of Consulting Engineers Group of African Member Associations (FIDIC GAMA), which mainly involves collaboration on training initiatives and attending regional conferences. • Internationally: WFEO and the International Federation of Municipal Engineering as well as bilateral links with the Royal Academy of Engineering, Harper Adams University, the Institution of Agricultural Engineers, the US Academy of Science, and the Institute of Public Works Engineering Australasia.
The South African Institute of Agricultural Engineers (SAIAE)	Bottom-up initiative to improve policy coordination in the engineering community at international level: SAIAE led the establishment of the Pan-African Society of Agricultural Engineers (PASAE). Thanks to funding from the Academy, PASAE was created as a "network of professionals in academia, research, industry and policy, as well as companies with interest in the application of engineering principles in agriculture".

Policy influencing actions

Engaging with the government **through consultations and advising on regulations** is often regarded as the responsibility of ECSA, larger PEIs, or supranational organisations, such as PASAE. Given the diversity of engineering organisations in South Africa, however, it can be difficult for PEIs to agree on common topics when dealing with ECSA and the government.

SAICE brought PEIs of different engineering disciplines together at the **SAFE** through a MOU. SAFE aims to improve collaboration between PEIs in addressing common issues, such as accreditation of CPD courses, graduate internship schemes, and procedures for professional registration. This helps PEIs to **develop a stronger voice** and achieve better results in common areas. For example, SAFE brought together PEIs, ECSA and the Department of Public Works and Infrastructure in a workshop on ensuring effective and financially sustainable CPD courses.

Although **influencing policy** is not one of their core missions, PEIs such as IEEE-SA and the Clinical Engineering Association of South Africa (CEASA) encourage their members to do so in a private capacity.

For example, under the auspices of ECSA, South African PEIs recently met with Minister of Public Enterprises Pravin Gordhan to discuss the power supply challenges of Eskom (a public electricity utility), specifically its operational challenges, engineering, technical capacity, restructuring, and financial viability.

Following this engagement with the minister, the engineering community was "asked to propose a framework for working with Eskom and the ministry to find solutions" in several areas. In consultation with ECSA, the minister tasked the chief executive officer (CEO) of the SAIEE to "present him with their analysis of the challenges facing Eskom and to propose how the South African engineering fraternity could get involved in, and assist, Eskom and the minister to develop a coherent plan"[40].

Furthermore, CESA has successfully persuaded some public bodies to include CESA membership as a qualifying factor for selecting suppliers. CESA has a specific objective to advocate for quality over cost in public expenditure and **address the slowness of government payments**, which is seen as a deterrent to quality. IMESA is also involved in a **National Treasury initiative** to identify and tackle the various challenges for municipalities that are hampering service delivery.

IMESA's web-based tool to build the capacity of local authorities

As part of a National Treasury initiative, IMESA worked with senior engineers to develop manuals and guidelines to build the engineering capacity of local government employees, and support them in addressing issues related to urban planning, rising sea levels, and droughts. IMESA also developed the web-based tool Asset Management Programme Learning Environment and works with SALGA to establish a core skills database. The tool is available to municipalities via the IMESA website. IMESA provides capacity building to local authorities (for example, through its annual conferences) and collaborates with SAIEE on electrical engineering issues.

PEIs supporting the government's response to the COVID-19 crisis

In May 2020, SAAE sent a letter to President Ramaphosa with engineering advice on addressing post-COVID-19 challenges, envisaging "a series of advisory notes on crucial issues to inform and support the decisions of all tiers of government". The letter also stated that SAAE's Fellows would be "available to provide further information and would be honoured to be called up to engage with government to assist with the implementation of its recommendations".

CESA was part of the Construction COVID-19 Rapid Response Task Team, a liaison forum with government decision-makers on how to safely get the engineering profession back to work, mitigate the damage to the economy, and stem the tide of unemployment.

40 'Engineering professions ready to assist in power supply solutions', Crown Publications, 19 February 2019.

PEIs are also involved **in publishing technical advice, research papers and reports**, whether on an unsolicited basis or upon commission from the government. Every five years, SAICE publishes a report (The infrastructure report card) that assesses the status of South Africa's infrastructure[41]. The report is useful to the government, and WFEO adopted it as a model for other countries.

SAAE has produced several research papers for the government on **engineering-related challenges**, including the paper on South Africa's technical readiness to support the shale gas industry[42], commissioned by the Department of Science and Technology. Published in 2016, the paper outlines several interventions that the country needs to develop a domestic shale industry. The report was considered by the Government Cabinet and was widely disseminated. The paper also attracted considerable public and commercial interest.

Engineering organisations also advocate with the government to **expand diversity in the profession**. The Black Business Council in the Built Environment is the "apex organisation of black construction and professional organisations in the country" whose main objective is to "engage government and other statutory bodies to influence the drafting and implementation of appropriate legislation in order to create an **enabling environment for the black constituency in the building and construction industry**"[43].

IMESA is trying to **raise awareness of the importance of hiring women** in municipalities by organising conferences focused on breaking the glass ceiling and by involving women engineers as speakers.

The **main issues preventing South African PEIs from establishing effective relationships with the government** are reported to be the high level of fragmentation and poor networks within public policy and the engineering community.

Another challenge, as acknowledged by a member of the EAP Board, is the lack of trust between the government and engineers. This might be exacerbated by segregation issues, as public service organisations do not reflect the diversity of races and ethnicities in the country, and public services (and some PEIs) tend to be dominated by white male staff.

Another obstacle experienced by PEIs is the **government's perceived insufficient recognition** of engineering's contribution to the country's economy and society in general. SAIAE's views suggest that this is a more significant issue among smaller specialisms, such as agricultural engineering, which is perceived to attract very little interest from the government.

8.2 PEIs' relations with industry

PEIs in South Africa can play an important role in **voicing industry's concerns and proposals** to the government, and helping the industry and academia to connect better. Because companies primarily have commercial objectives, the government does not tend to be receptive to approaches directly from companies. PEIs therefore have a crucial role to play in representing the interests of the industry in a way that is more receptive for the government.

Some South African PEIs make efforts to better **connect industry with academia.** For example, the South African Society for Engineering Education (an autonomous society with the mission of fostering excellence and innovation in engineering education) brings together the industry and academia in workshops that focus on how to incorporate the industry's needs into university curricula and activities. PEIs also make efforts to connect students and professionals. For example, the SAIMechE runs an annual conference that **connects students and industry members** in Western Cape.

SAICE is working on improving the communication between its provincial branches and local universities, as its members work in industry and can provide universities with useful contacts and expertise. SAICE has also developed **SAICE Connect** – a platform designed to connect firms with qualified engineers, technicians, and technologists. Some PEIs in South Africa have dedicated sub-groups for young members (generally under 35 years of age), which organise activities tailored to the specific needs of that demographic. See the box on the next page for an example from CESA.

41 SAICE to launch SA's third infrastructure report card, SAICE, 25 August 2017.

42 South Africa's technical readiness to support the shale gas industry, Academy of Science of South Africa, 2016.

43 About us, BBCBE website, undated.

Young professional forums and their activities

CESA's Young Professionals Forum (YPF) is available to all qualified professionals in the engineering and built environment sector up to 35 years of age. Some of YPF's major events include:

- **The YPF Job Shadowing Initiative**: More than 800 school students per year are provided with an engineering job shadowing opportunity.
- Regular **meet-and-greet** sessions and general **topical discussions**.
- **The CESA Young Professionals Sustainability Imbizo**: Launched in August 2013, this annual mini-conference is a springboard for future leaders that provides them with a platform to discuss their role and position in the community.
- **The CESA Aon Engineering Excellence Awards**: YPF supports the award categories **Mentor of the Year, Young Engineer of the Year** and **Mentoring Company of the Year** to further promote and encourage the development of young professionals.
- **CESA Indaba, GAMA and the FIDIC Infrastructure Conference**: Young professionals take part in national and international committees and conferences.
- One initiative of SAFCEC's **Young Contractors Forum (YCF)** was an educational tour of the PPC cement factory in Piketberg, involving groups of young people from CESA's YPF and the Young Graduates Forum of the Provincial Government. The tour was well attended and developed a positive relationship between PEIs and the industry.

8.3 PEIs' relations with academia

In South Africa, similarly to other African countries, there is a **gap between academia and industry**, caused by a teaching level and engineering curricula that are not suited to the real-life challenges of engineering.

According to stakeholders interviewed for this research, professors in higher education in South Africa lack practical or research experience, and more professionals should be brought into academia. Furthermore, undergraduate curricula are not sufficiently focused on teaching students problem-solving skills, which are fundamental for the profession. At the graduate level, curricula should be adapted to be more industry-responsive. This will help fresh graduates to be operational once they enter the labour market, especially if they join the government.

ECSA is mandated to conduct **accreditation visits** to educational institutions that offer engineering programmes to determine whether the engineering qualifications offered can be recognised by the Council for purposes of registration.

Other PEIs are involved in **reforming and improving engineering curricula** to bridge the gap between academia and industry. For example, IMESA has been involved in helping the University of Cape Town and Stellenbosch University to reform their engineering curricula and make them more relevant to the needs of local governments, while North-West University has asked IMESA for support in developing an urban curriculum.

Some PEIs are also involved in initiatives to **reward engineering excellence in academia**, and they organise events and **competitions/awards** for engineering students. The COET and the SAIIE both run award schemes for the best engineering students at technical universities in South Africa, and IMESA grants a 'Best Student Award'.

Some PEIs have committed to having their representatives regularly available as **guest speakers** at universities to discuss future career options with students. IMESA also tries to increase work placement opportunities for students in local municipalities through **advocacy activities**. This is a necessary requirement for many engineering degrees, but there are not enough openings available or senior engineers willing to serve as mentors. IMESA also offers a bursary scheme for full-time studies in the field of civil engineering at a recognised tertiary educational institution in South Africa.

PEIs and academia also collaborate on **producing knowledge** that can be of use to engineering professionals, including the government. One example is the client guide for improving infrastructure project outcomes. The publication is co-sponsored and co-published by EAP and the School of Construction Economics and Management at the University of the Witwatersrand. It is intended for practitioners, professionals, students, lecturers, researchers, decision-makers, and stakeholders with an interest in infrastructure projects. The guide's content draws directly on the experience of the university: "Much of what is written in this guide has been tried and tested in the university's capital expansion programme, which commenced during 2008, and during the first phase of the delivery of two new universities in South Africa[44]."

8.4 PEIs and the media

Most South African engineering organisations are taking advantage of the visibility and communications opportunities offered by social media. Social media allows PEIs to **reach potential and current members** as well as a wider audience (members of the industry, government, and academia in general), and to **communicate and advocate for their priorities.**

ECSA is active on social media, and posts regular updates on its Facebook and Twitter accounts about CPD and events. ECSA also uses social media to raise awareness of its free webinars on the requirements and benefits of registration.

SAICE and IMESA also use Facebook to share news about their events, invite members to CPD courses, and announce deadlines for submitting paper abstracts for conferences. SAICE and CESA consistently post on Twitter, LinkedIn, and Facebook to promote and publish their webinars, which can also be found on their **YouTube channels** (SAICETV and CE-tv, respectively). They also use their channels to publish videos of conference sessions and interviews with their CEOs and members.

CESA promotes its **engineering priorities** and voices the profession's concerns by publishing news articles and its CEO's opinion pieces. In one of these pieces, he urged the government to professionalise South Africa if the country wanted to rely on infrastructure development as a driver for economic growth. He also wrote that CESA had been proactive in connecting the Department of Public Works and Infrastructure with a network of highly qualified engineers, who are looking for work and are ready to play their part in South Africa's development.

SAAE uses its website to **amplify the reach of its messages**. For example, it published the above-mentioned letter[45] to President Ramaphosa during the COVID-19 pandemic. SAICE's Water Division also reposted on Facebook its advisory note *Building a better post-COVID-19 water sector*, which was addressed to the government.

There are specific **online media and magazines for engineering** in South Africa, such as **engineeringnews**.co.za and **engineerit.co.za.** Crown Publications publishes several monthly business-to-business engineering magazines, such as *Capital Equipment, Construction World, Electricity + Control, MechChem Africa, Modern Mining* and others[46].

Some PEIs have their own publications, such as SAICE's monthly *Civil Engineering Magazine*[47], and SAIMechE's twice-monthly digital magazine[48].

8.5 Appendix: overview of key engineering stakeholders and priorities in the country

Key stakeholders

There are several PEIs and related organisations operating in South Africa, as the South African PEI scene is vast and covers numerous disciplines. The main organisation is **SAAE** – a learned society distinct from PEIs. SAAE's key function is pooling engineering expertise for the technological welfare of South Africa and acting as a source of expert advice on global competitiveness and the quality of life of the nation.

ECSA is a statutory body established under the Engineering Profession Act. ECSA's primary role is to regulate the engineering profession through the accreditation of engineering programmes and registration of professionals in specific categories. It is the only body in the country authorised to register engineering professionals and bestow engineering titles. ECSA is also responsible for the regulation of the practice of registered engineers.

44 Client guide for improving infrastructure project outcomes, Watermeyer, R., April 2018.

45 See sub-section 'Policy influencing efforts'.

46 Engineering professions ready to assist in power supply solutions', Crown Publications, 19 February 2019.

47 The Civil Engineering Magazine website.

48 SAIMechE's website.

IMESA promotes excellence in the engineering profession for the benefit of municipalities and their communities.

The list of PEIs that are recognised in South Africa[49] also includes, among others: CESA; IEEE-SA; SAICE; CEASA; SAIAE; the South African Forum of Civil Engineering Contractors (SAFCEC); the South African Institution of Mechanical Engineering (SAIMechE); the SAIEE; the South African Institution of Chemical Engineers (SAIChe); and the SAIIE.

Engineers Against Poverty (EAP) is an independent organisation that bridges the divide between research, policy, and practice. Its mission is to promote infrastructure policy and practice with sustainable impacts that contribute towards the elimination of poverty.

Non-governmental PEIs and engineering organisations

Institution of Municipal Engineering of Southern Africa	South African Academy of Engineering Institution of Chemical Engineers	The Institute of Electrical and Electronics Engineers South Africa Section		The South African Institution of Civil Engineering
South African Forum of Civil Engineering Contractors	Clinical Engineering Association of South Africa	South African Institute of Agricultural Engineers	Southern African Institute for Industrial Engineering	South African Institution of Mechanical Engineering
Consulting Engineers South Africa	South African Institute of Electrical Engineers		South African Institution of Chemical Engineers	Engineers Against Poverty

Main universities

Nelson Mandela University	University of Cape Town	North-West University	Cape Peninsula University of Technology	Stellenbosch University	Rhodes University	University of KwaZulu-Natal
Tshwane University of Technology	University of the Witwatersrand	Walter Sisulu University of Technology	University of Pretoria	University of South Africa	Durban University of Technology	
University of Johannesburg	Mangosuthu University of Technology	Central University of Technology	University of Western Cape		Vaal University of Technology	

49 See the full list of recognised PEIs in South Africa (also referred to as voluntary associations).

Governmental bodies

Department of Water Affairs	Department Provincial and Local Government	Department of Home Affairs	Department of Health	Department of Transport	Department of Human Settlements
Department of Communications and Digital Technologies		Department of Mineral Resources	Engineering Council of South Africa	Department of Employment and Labour	Department of Trade, Industry and Competition
Department of International Relations and Cooperation	Department of Agriculture, Land Reform and Rural Development		Department of Science and Technology	Department of Mineral Resources	Department of Agriculture, Forestry and Fisheries
Department of Higher Education and Training			Department of Public Works and Infrastructure		

Private sector (top engineering companies)

Aurecon	BHP Billiton	Voith	Eskom Holdings	Alpro	Transnet Engineering	Argent Industrial	Dihlase Consulting Engineers	SA Five Group
Kenwhill Engineering Solutions	Murray & Roberts Construction	AA Geomatics	Zuriel Engineering	ATTC Civil Engineering Solutions	G54 Engineering Services	Stanley Design Services		
PSJ Engineering	Tar-A-Way	African Eagle Projects	Big Five Group of Companies	Bright B Electrical and Generator Services	Azwifarwi Trading & Projects	Zuriel Engine		

National priorities for engineering

The National Digital and Future Skills Strategy, prepared by the Department of Communications and Digital Technologies and published in 2020, sets out "a structured series of initiatives intended to contribute to the capacities of South Africans to meet the challenges arising from the increasing deployment and adoption of digital technologies in economy and society"[50]. Engineering is largely represented in the "jobs of the future" identified by the strategy.

The strategy envisages the development of curricula for computing, coding, and a wide range of in-demand digital skills. This curriculum review must "be supported by teacher digital skills advancement and digital infrastructure investment in schools, over and above investment in tablets and broadband". The strategy identifies ECSA as one of the representative bodies that can play a part in the implementation of the Digital and Future Skills Strategy.

50 National Digital and Future Skills Strategy, Department of Communications and Digital Technologies, 23 September 2020.

9.0 Uganda

9.1 National PEIs' relations with policymakers and supranational governance bodies

Relations between PEIs and policymakers

PEIs in Uganda regularly engage with government, although they do not receive direct funding from government. Interactions between PEIs and governmental institutions take the form of, among others, quarterly meetings (although not on a systematic basis), appointments to boards and committees, conferences, and social evenings. PEIs habitually participate in consultations and advise on regulations. According to Eng. Dr Lubwama Kiyimba, ERB Vice Chairperson and UIPE Board Member, UIPE regularly interacts with policymakers on different matters ranging from capacity development of engineers (as they prepare them for registration) to engineering research and internships opportunities for graduates. See Table 4.1 for an illustration of Ugandan PEIs' links with policymakers at the local, national, regional, and continental levels.

Table 4.1: Links between Ugandan PEIs and policymakers

Level	Key links with the policymakers
Local	• **UNABCEC** works with Kampala Capital City Authority (KCCA) advocating for realistic/ fair bid qualification requirements and District Local Governments (DLGs). • UIPE works with district engineers and chief administration officers primarily on membership recruitment activities.
National	• UIPE collaborates with the Ministry of Works and Transport (and its engineer-in-chief), UIPE's current president, and with other ministries (including the Ministry of Energy and Mineral Development, the Ministry of Disaster Preparedness and Refugees, and the Ministry of Water and Environment). UIPE members sit on ad hoc governmental committees when ministries request engineers' input. UIPE's Council appoints members to take part in these committees based on their competencies, areas of specialisation, and experience. For instance, UIPE currently sits on a committee on publicity and protocol issues. UIPE also requests funds from different ministries and agencies to support their activities. UIPE interacts with ERB as a regulator almost on a day-to-day basis, as the registration process starts at UIPE and ends with ERB. • **ERB** is in constant communication with policy bodies (ministries, government agencies and, more rarely, the Parliament) about engineering practice and its regulation in Uganda. The government consults ERB on technical matters when they need engineering guidance or input. For instance, the National Building Review Board and the Uganda Communications Commission systematically consult ERB when they roll out policies. The new Rural Electrification Agency Board was reconstituted to include an electrical engineer nominated by ERB. • **UNABCEC** collaborates with several ministries, as well as the Office of the President of Uganda, the Parliament of Uganda and other entities such as the UNRA, the PPDA, and National Medical Stores. UNABCEC is "represented on various relevant committees: the Construction Industry Development Committee under the Ministry of Works and Transport, Multi-Stakeholders' Group of the CoST Uganda Chapter, the Construction Sector Skills Council under the Ministry of Education and Sports, the Uganda Technical College – Lira 6th Governing Council, and the Technical Vocational Education and Training Policy Implementation Working Group under the Ministry of Education and Sports[51]". • The IEEE Uganda Section collaborated with the Ministry of Health to raise awareness of the COVID-19 pandemic by creating and disseminating posters and videos.

51 Annual report 2019, UNABCEC, undated.

Level	Key links with the policymakers
Regional	• UIPE is a member of the Eastern African Federation of Engineering Organisations. It attends joint conferences and works with other members on addressing the shortage of qualified local engineers in Eastern Africa and the dominance of Chinese, British and South African engineers. • Together with its counterparts in Tanzania, Kenya and Rwanda, ERB is part of a **mutual recognition agreement** (MRA) for engineers in the East African Community (EAC), deposited at the EAC Secretariat (Burundi and South Sudan are yet to sign). This allows registration certificates and practising licences issued in one EAC country to be recognised in the whole region. In an interview, the ERB registrar observed that EAC countries benefit from "sharing skills and know-how across the region". The MRA operations are overseen by a coordination committee. The committee is composed of registrars from the member countries, which meet annually to share updates on the activities of the MRA and how they are implemented. The ERB registrar noted that through the MRA there is scope for influencing policy at the supranational level, in particular on how to encourage the hiring of engineers from the region.
Continental	• UIPE is a member of FAEO. Interactions with FAEO take the form of regular information sharing, events, and email or telephone contacts. Overall, UIPE finds FAEO supportive, and points at networking as one of the elements that work best in this cooperation, as FAEO membership gives access to all African engineering bodies under the Federation. • UNABCEC is a member of the African Federation for Construction Contractors' Association, the CoST Infrastructure Transparency Initiative and the International Infrastructure Investment and Construction Forum, and its president attended the 10th Forum in Macao in May 2019. UNABCEC finds it easy to engage with these supranational bodies, and it does so to represent the interests of Uganda's construction industry on an international level and learn how UNABCEC can better contribute to the development of Uganda's construction industry. These forums also allow for discussion around fair business practices in infrastructure development and the formation of partnerships and joint ventures between individual firms in the respective associations to advance their capacity to deliver projects. • Uganda Association of Consulting Engineers (**UACE**) is a member of the International Federation of Consulting Engineers (FIDIC) and FIDIC Africa. The latter "represents the interests of the consulting engineering industry in the African region and supports FIDIC activities at both national and regional level"[52]. In 2019, UACE hosted the annual FIDIC Group of African Member Associations Conference in Kampala in collaboration with the Ministry of Works and Transport, UNRA and KCCA. This major event was organised for networking and capacity building in consulting engineering in Africa, bringing national consulting engineering associations together. The conference focused on the consulting engineering industry in a specific sense, but broadly on the construction and engineering industry in Africa. The engineer-in-chief of the Ministry of Works and Transport co-hosted a paper presentation on public–private partnerships in infrastructure development in Uganda.

52 FIDIC Africa website, undated.

Level	Key links with the policymakers
International	• UIPE has been engaged with WFEO for the last 10 years, sharing resources and governance arrangements, exchanging knowledge, and supporting the international mobility and employability of engineering graduates. As part of this cooperation, UIPE is invited to attend workshops, conferences, and networking events.

Policy influencing initiatives

PEIs in Uganda have been active in voicing the concerns of the profession, including lobbying governmental bodies. Influencing the government is seen as particularly important for protecting and advancing the profession. Some PEIs in Uganda report that they have found it difficult to engage with the government because of corruption, political interference, and a reported lack of political willingness to support the engineering profession. The fact that not all engineers register with UIPE and ERB, and not all construction companies register with UNABCEC poses additional challenges in engaging with the government as a legitimate voice for engineering.

While ERB can easily access policymakers, its advice is not binding, and it is only one of the several actors that the government can consult. ERB regrets that, to date, the Board has not been proactive in influencing policy and has been waiting to be approached by the government.

One interviewee pointed out the limited time capacity of the Board Members, who do not work full time as they combine their function with a second job. They also noted that the Secretariat lacks capacity and the necessary personnel to champion policy influencing. UNABCEC regularly lobbies Government on behalf of industry to ensure fair and transparent practices in the construction sector, advocating for "better policies, a conducive business environment as well as a levelled playing field[53]". UNABCEC accompanies the enactment of regulations in the construction industry, including on procurement. One interviewee pointed out that UNABCEC policy-influencing actions include submitting papers, meeting physically with policymakers (for example, at their bi-annual Stakeholders' Engagement Forum), and engaging specific Members of Parliament on specific policies. Some of its recent and important lobbying efforts include the revision of the Engineers Registration Act, the adoption of the UCICO Bill, and the National Local Content Bill 2019 (for details, see the boxes on the next page).

53 Annual report 2019, UNABCEC, undated.

UNABCEC's efforts to influence the UCICO Bill

What is the UCICO Bill?

The UCICO Bill aims to establish the Uganda Construction Industry Commission. This Commission will regulate and coordinate the construction industry, and register contractors, consultants and other service providers engaged in the national construction industry. The Bill will regulate the awarding of engineering contracts and will fight 'briefcase contractors' that are not registered with UNABCEC to address the "rising number of collapsing buildings in Kampala[54]".

What policy aspects did UNACBCEC try to influence?

UNABCEC prepared a number of proposals to streamline the effectiveness of the Bill. It actively engaged with the government to be granted authority to act against non-compliant members and fake contractors. UNABCEC also lobbied for the establishment of the Uganda Construction Industry Commission to regulate the industry.

How did UNABCEC try to influence the Bill and with what results?

As a result of these actions, the Ministry of Finance, Planning and Economic Development issued a letter reiterating its "earlier guidance to the Ministry of Works and Transport that a mechanism be set under the latter to regulate the industry, following the Cabinet decision to halt the creation of new agencies[55]". The UNABCEC Board has been working closely with the Parliamentary Committee on Physical Infrastructure to move a private members' bill on the same issues. Furthermore, the Cabinet of government has proposed a regulation to vest UNABCEC with regulatory powers. If this legislative change is approved by the Parliament, all construction companies will have to register with UNABCEC to operate in Uganda. These regulations are still in Parliament and have been put on hold following the Head of State's pronouncement on the creation of new agencies and have not been enacted yet.

UNABCEC's efforts to influence the National Local Content Bill 2019

What is the National Local Content Bill 2019?

The Bill imposes local content obligations on people who use public money or Uganda's natural resources, or who carry out an activity requiring a licence, to prioritise Ugandan citizens and companies in public procurement.

How did UNABCEC try to influence the Bill and with what results?

In 2019, Karuhanga and his delegation presented UNABCEC's recommendations for the proposed amendments in the National Local Content Bill to the Parliamentary Committee on Finance, Planning and Economic Development. In May 2020, the Parliament passed the Bill into law, but in October, President Yoweri Museveni refused to assent to the Bill, as it conflicted with the East African Monetary Union article against non-tariff barriers to trade.

UIPE lobbied PPDA to include **special clauses in infrastructure-building contracts** procured by government ministries, departments, and agencies, which stipulate a threshold under which contracts must be awarded to national and resident providers (for details, see the boxes on the next page).

54 'Engineers push for enactment of UCICO Bill to halt building disasters', Ninsiima, C., 27 April 2016.

55 Annual report 2019, UNABCEC, undated.

UIPE's lobbying efforts to promote local content in public procurement

To contrast the disproportionate award of public procurement contracts to foreign firms, UIPE successfully lobbied PPDA to include special clauses in infrastructure-building contracts procured by government ministries, departments, and agencies (Guidelines on Reservation Schemes to Promote Local Content in Public Procurement, 2018). These clauses stipulate a threshold under which contracts must be awarded to national and resident providers. Foreign contractors must also subcontract at least 30% of the value of their contract to local companies (who are more likely to employ local engineers).

The implementation of the guidelines was not straightforward and, in 2019, UNABCEC, which was also involved in the formulation of this policy, noted that it was fully engaged with the authorities to resolve these matters. UNRA considers itself the pioneer institution in implementing the guidelines.

In 2020, PPDA reported on the progress of the implementation of the reservation scheme and noted that there had been an increase in the value of contracts for works awarded to local providers. However, these lobbying efforts are not systematically successful, especially when major economic interests are in the balance. For example, procurement tenders in the oil industry are not currently affected by the reservation scheme. One interviewee noted that discussions are ongoing to amend the guidelines.

UNABCEC is aware that apart from getting more public work thanks to the reservation scheme, local contractors also need capacity building, and it lobbies the government for this. For example, at the UNABCEC Stakeholders' Engagement Forum in July 2019, UNABCEC President Francis Karuhanga directly addressed the Minister of State of Works, calling for a government programme to **build the capacity of local contractors** to construct paved roads. The minister responded favourably, acknowledging that, at the time, local contractors were not able to compete for projects with foreign firms and their capacity needed to be built. UNABCEC has also taken part in the formulation of The PPDA Amendment Bill, aimed at reducing bureaucracies as well as ensuring efficacy and transparency in the procurement of public assets. The Bill is in Parliament, awaiting the President's approval.

Another example of collaboration between UNABCEC and the government is their recent joint webinar, which featured the Minister of Works and Transport and speakers from PPDA and UNRA. The webinar aimed to discuss challenges, opportunities, and Uganda's actions to build the capacity of local contractors and suppliers in the road sector. UNABCEC noted that it promoted a scheme with UNRA to support contractors seeking training and experience in bitumen pavement works. UNABCEC also noted that some DLGs offer preferential treatment to UNABCEC members in the bidding process, by considering the possession of a UNABCEC certificate as an added advantage. All in all, UNABCEC does not find it easy to access policymakers. One interviewee pointed out that UNABCEC normally attempts to engage them through correspondence initiatives, the majority of which are never responded to. UNABCEC's attempts to hold physical meetings, especially with the Head of State, have repeatedly been frustrated.

UIPE has also been active in **lobbying the government:** besides petitioning for local content in public procurement (see box on the left), UIPE has been campaigning about the lack of inclusion of electricians and technologists in the Engineers Registration Act of 1969. UIPE envisaged an amendment to the Act that would allow allied professionals and semi-professionals (considered the bedrock of all engineering works) to register.

Furthermore, in December 2019, UIPE conducted two workshops, inviting electricians and technicians to become members. In an interview, Dr Kiyimba explained that currently these categories can be registered, but cannot receive the title 'Eng.', and so ERB has also put forward proposals on this and other matters to reform the Act. Dr Kiyimba expects the Act to be amended.

To counter the low level of registrations of electricians and technicians, the new president of UIPE stated in a recent interview that he would work on "empowering them legally through a proposal made under the Engineers Registration Amendment Bill (2018) to register technicians and technologists under law"[56]. At the end of 2019, the amendment was with the First Parliamentary Counsel under the Ministry of Justice and Constitutional Affairs for final drafting, before the Cabinet's and the Parliament's consideration.

56 UIPE Newsletter July–September 2020, UIPE, 16 October 2020.

ERB and UIPE are working to **raise awareness** of the threats posed by unqualified and unregistered engineers. They also **advocate** for engineers to register with ERB and for companies to hire registered engineers. In recent years, a number of poor infrastructures have resulted in incidents, such as building collapses. These buildings were often constructed by engineers who were not qualified and not registered with ERB. However, ERB does not have the authority to take punitive measures against them. Eng. Dr Isaac Mutenyo, ERB Chair, stated that the government employs many people "in engineering positions [that] are not registered with ERB because the government does not enforce the Engineers Registration Act diligently"[57]. Other efforts conducted by UIPE in the interest of its members include bringing a court case against the introduction of professional fees for engineers by the Uganda Revenue Authority.

PEIs organise outreach activities to raise awareness of registration among engineers in local government, to demystify the process of registration. UIPE Vice President Eng. Dr Mark Henry Rubarenzya has also called on the government to enforce the existing regulations of the Engineers Registration Act to ensure all engineers are part of the various bodies and to comply with the regulations and requirements of the bodies. ERB has also warned urban authorities not to approve plans before scrutinising the identity of the engineers responsible and their registration with ERB.

Furthermore, ERB encourages government and local authorities (such as KCCA) to **appoint engineers to executive director positions** for the management of cities. Michael Odong, former ERB Chair, said the government should "stop employing incompetent cadres to head technical offices and become supervisors of technocrats" because this could lead to "new urban slums"[58]. He added that it is important that the design of new cities is made by competent professionals. ERB considers that the government should consult with engineers on this and involve them in the planning process.

9.2 PEIs' relations with industry

Ugandan PEIs collaborate with industry on several issues, including bridging the gap between academia and industry, and creating awareness of the importance of registration. UIPE interacts with the private sector as an entity or via its members on graduate placements, capacity development, or by requesting financial support for its activities.

UIPE conducts **outreach visits** to private companies to raise awareness among engineers, technicians, and technologists about the benefits of registering. UIPE's intervention can also be requested when issues arise between contractors and engineers, or between ministries and contractors. UIPE typically appoints an adjudicator to help settle these issues.

As the link between the construction industry and the public, and development partners and the government, UNABCEC brings its members from the construction industry together to promote and protect their shared interests. UNABCEC aims to bring all industry players together with the common goal of developing the industry, and to bridge supply chain gaps experienced by its members. For example, UNABCEC led a **local contractors media tour** to show that it has the capacity to implement major contracts, which it is rarely awarded as foreign companies are usually awarded large contracts. UNABCEC has signed several **memorandums of understanding** with financial institutions, suppliers and manufacturers of construction materials and/or equipment for special offers to their members to help them in the day-to-day running of their businesses. These include a deal with NCBA Bank Uganda that is offering an exclusive Trade Finance package to UNABCEC members. The partnership aims to ease the financial load on UNABCEC members who are contractors by offering them access to bid bonds of up to £100,000 (UGX 500 million) to fund their projects. UNABCEC also partnered with Stanbic Bank to ease access to funding for the construction industry. Stanbic Bank provides "customised solutions to [UNABCEC] members and helps them become effective partners with UNRA", thus supporting the delivery of infrastructure projects. Other partnerships that provide special conditions, services and discounts for UNABCEC members are those with Libitco Technical Supplies Uganda Limited; Kansai Plascon Uganda Limited; Bata Shoe Company Uganda Limited; Ganatra Plant and Equipment Limited; Africa Road Furniture Limited and Tyre Express Uganda Limited.

57 'Exposure of quack engineers protects public from disaster', Kiyonga, D., 2 August 2020.

58 'Engineers' board trashes approved cities as slums', Daily Monitor, 6 June 2019.

Another example of collaboration between PEIs and industry are graduate placements. The transition between academia and industry is one of the biggest challenges for young engineers in Uganda and in SSA overall. PEIs believe that industry has a key role to play in providing training for fresh graduates and equipping them with the necessary skills. Both UNABCEC and UIPE offer graduate training programmes (GTPs), which benefit both their member companies and young engineers (for more details, see the boxes below).

UNABCEC's GTP

In 2019, UNABCEC piloted a competitive GTP as part of its Construction Industry Advancement Programme. The programme is open to final-year students enrolled in construction- or engineering-related courses in two public universities.

UNABCEC matches young graduates with corporate members' training offers. Companies benefit from the absence of recruitment burden and costs, and participants' "greater flexibility and willingness to learn, innovation and energy, higher skills and a greater optimism". The programme also contributes to enhanced workforce development (such as "enhanced loyalty, reduced turnover, shared organisational culture") and greater workforce diversity.

The programme aims to bridge the gap between academia and industry by empowering "tomorrow's contractors and building the future for the construction industry". After completing the programme, trainees can be offered full-time employment. UNABCEC opened its second call for applications in December 2020, inviting all final-year engineering students and graduates who meet the requirements.

UIPE's GTP

PEIs, including UIPE, strive to connect their corporate members with recent graduates to help inexperienced engineers build practical skills and to smooth their entry into the job market. The purpose of UIPE's GTP is to "help graduate engineers bridge the skills and experience gap between education and professional registration". The initiative is supported by the Royal Academy of Engineering as part of its GCRF Africa Catalyst programme.

The 2020 GTP targeted unemployed graduates who had completed their bachelor's degree between 2018 and 2020. The programme aimed to offer them placements "in the different [engineering] institutions/organisations" and training with "structured guidance and oversight from a supervising engineer appointed by UIPE".

The GTP brings together graduate engineers, the industry and UIPE/ERB, so that trainees have the necessary experience and skills to later qualify for corporate membership at UIPE and to register with ERB. UIPE also offers a mentorship programme for graduate members to help them grow in their practice.

9.3 PEIs' relations with academia

Ugandan PEIs have connections with academia, and in particular with Ugandan universities, through joint events, their involvement in the accreditation of engineering courses and training programmes for recent graduates and final-year students. See the box below for details of a UIPE and ERB MOU with the National Council of Higher Education.

UIPE and ERB MOU with the National Council of Higher Education

In 2018, ERB and UIPE signed a tripartite MOU with the National Council of Higher Education to reinforce their supervisory role. The Council is mandated to accredit institutions' academic and professional programmes in consultation with UIPE and ERB.

Members of the two organisations sit on the Joint Accreditation Committee whose aim is to ensure the quality of education and training of engineers at universities and other tertiary institutions in Uganda.

Only those with a degree from an accredited course are able to register with UIPE and ERB. According to Dr Kiyimba, UIPE and ERB have room to influence the quality of future graduate engineers and to inform on how the different curricula can address skills gaps. UNABCEC is also connected with public universities and tertiary institutions to discuss the development of industry-driven curricula.

UIPE also engages in **awareness-raising activities** with university students about key aspects of the engineering profession and the registration of engineers with professional bodies. Dr Rubarenzya from UIPE spoke to young engineering students from various universities during a lecture at the Resilient Africa Network, organised by the IEEE Uganda Section. In her lecture, she highlighted that "ethics, integrity, sustainability, and professionalism are the things which are going to help [the] profession and nation to grow". UIPE also visits universities to recruit students (for example the College of Engineering, Design, Art and Technology, and the Uganda Military Engineering College), explains what the institution does, and why and how to join it.

PEIs in Uganda also engage with universities by co-organising **conferences and workshops**, such as the Virtual Students' Workshop, which was organised by UIPE and students from Busitema and Makerere University. The workshop was focused on the role of engineering in addressing the challenges created by COVID-19. It welcomed Ugandan students' ideas on how to use the skills they have attained thus far to make the best of this time and looking forward to post-COVID-19. Student competitors presented their essays and Eng. Joseph Oriono Eyatu, Commissioner for Rural Water Supply and Sanitation, gave a keynote speech.

9.4 PEIs and the media

Ugandan PEIs use the media to promote and advocate for engineering priorities, regularly using TV channels, newspapers, and online press, such as *NewVision* and *Daily Monitor,* to voice their concerns in relation to the industry. They also amplify their messages through their newsletters and journals (such as *The Contractor* and *The Engineer*)[59], and through their social media channels, including their Twitter, Facebook, and LinkedIn pages. See the box below for details of UNABCEC's media strategy.

How UNABCEC uses the press to voice its concerns of the profession

UNABCEC engages frequently with the media in its policy-influencing actions. UNABCEC features regularly in the press through articles in the print and online media written by the Association's Executive Director, Elizabeth Muhebwa. In a newspaper article[60] of September 2019, Ms Muhebwa outlined seven requests for the government to "assist local contractors [in the construction sector] to build their financial and technical capacities and enable them to compete favourably in the country's infrastructure development". She noted that these requests would contribute to creating employment (especially for young people), to strengthening the local construction industry and to boosting the economic development of the country. She also noted that they will help increase tax revenues through an increased tax base, and prevent economic and human capital outflows.

59 See The Contractor magazine website and The Engineer magazine website.

60 You can read the article in this Facebook post, published by UNABCEC.

The seven suggestions Ms Muhebwa put forward are:

- exclusive preference to Ugandan-/East African-owned companies in the procurement of works
- ensuring foreign companies subcontract or enter joint ventures on large infrastructure projects
- mandatory placement of graduate interns
- facilitating the acquisition of the revolving equipment lease fund onto the Uganda Development Bank, offering good financing terms
- initiating a 10-year strategic programme to train local contractors to build paved roads
- implementing an enterprise development programme to incubate and promote small and medium local contractors based on performance
- establishing a specialised training centre to train plant operators and mechanics.

On behalf of UNABCEC, Ms Muhebwa also used the media to expose "fraudulent practices in the procurement of construction works". In a recent online press article[61], she criticised the procurement practices in the second phase of the Uganda Support to Municipal Infrastructure Development Programme[62] for unfairly favouring foreign firms over local contractors. Ms Muhebwa considered that "these short municipality and city road projects do not fall under the major category projects that require sourcing of foreign firms" and that "national and resident (local) firms have the financial, technical and managerial capability to undertake most of these projects in each municipality/city".

Finally, in a recent press article[63], Ms Muhebwa stressed that the construction sector is an essential asset of any country's economy. She proposed several ways for the government to rescue the construction sector, which was hit very hard during the crisis and faced significant challenges even before the COVID-19 pandemic.

UNABCEC also **advocates** for the sector's interests on radio and television. In an interview[64] with NTV Uganda in 2019, UNABCEC President Karuhanga stated that no major infrastructure government contracts (bridges, roads) had been awarded to local contractors, despite existing local capacity to handle such projects. This was followed by another interview[65] with Ms Muhebwa, where she visited areas where local companies had been subcontracted for major infrastructure projects. The interview aimed to show that local contractors, who were usually subcontracted for minor works, had the capacity to handle major projects as well.

ERB also uses the media to voice its views on current affairs in the industry, especially with regard to the government. In June 2020, Ronald Namugera, ERB Registrar, told *NewVision*[66] that the "government's sustained investment in infrastructure was the right way to drive industrialisation" as the Minister of Finance gave infrastructure the "lion's share of funding [12.8%] in the national budget for the financial year 2020/21".

Two online newspapers[67] featured ERB Chair Dr Isaac Mutenyo's comments on the Karuma Hydro Power Dam, a project of the Ministry of Energy and Mineral Development. The newspapers reported that Dr Mutenyo "cautioned against the [government's] commissioning of [the] dam before working on defects that have been flagged by Uganda Electricity Generation Company Limited" (a parastatal company implementing the project). Dr Mutenyo said that "testing and commissioning a dam with well-known defects shall turn out to be very expensive during the operation and maintenance". Dr Mutenyo also noted that the delays of the government in completing land acquisition affected the implementation of the works too. Finally, it was also reported that the ERB Chair denounced the contractor's use of foreign engineers that were not registered with ERB, saying that this could put "the whole project in danger".

To **raise awareness** among the public about non-registered engineers and the misuse of the 'Eng.' title, ERB disseminated a press release[68] denouncing the "numerous publications in the media, campaign posters, advertisements and other published materials with illegal use of the title of engineer".

UIPE engages with the media to discuss relevant topics. According to UIPE President Eng. Ben Kyemba, UIPE intends to increase its online presence (for example, on social media) to boost its visibility.

61 'Local firms should take on city projects', Daily Monitor, 02 December 2020.

62 A $360 million loan from the World Bank/International Development Association.

63 'Government must rescue construction sector', Daily Monitor, 01 July 2020.

64 We are not given government contracts – engineers', NTV Uganda, 9 June 2019.

65 We have capacity for big national projects - local contactors', NTV Uganda, 15 June 2019.

66 'Engineers Back Govt Plan On Infrastructure', NewVision, 28 June 2020. Asterisk-marked sources are not currently available.

67 Daily Monitor and *NewVision.

68 You can see the press release in this Twitter post published by ERB.

9.5 Appendix: overview of key engineering stakeholders and priorities in the country

Key stakeholders

There are several PEIs and engineering organisations operating in Uganda. Details are set out below.

The **ERB** was established in 1969 under the Engineers Registration Act. It is a statutory body with a mission to regulate and control engineers and their profession in Uganda. The Board has wide-ranging powers to register and deregister engineers, restore and suspend their registration, hold inquiries, hear appeals, and appear as a respondent in cases brought against it in the High Court.

UIPE promotes the general advancement of the science and practice of engineering and its applications. It facilitates the exchange of information and ideas among its members.

UACE was founded in 1993[69]. It is responsible for representing the professional concerns and general business interests of its members in the field of consulting engineering in Uganda. UACE caters for its members in areas such as professional engineering ethics and standards, and client–consultant–contractor relationships.

UNABCEC aims to promote and protect the shared interests of its members and the construction industry through mobilisation, advocacy, networking, and innovative service provision.The **IEEE** Uganda Section is dedicated to advancing technological innovation and excellence for the benefit of humanity in Uganda.

Engineers without Borders – USA aims to increase long-term local capacity by providing engineering expertise. It has been present in Uganda since 2005[70], and it has numerous programmes and community partnerships.

Several ministries are involved with engineering in Uganda. The **Ministry of Works and Transport** formulates policies and plans, sets standards, builds capacity, carries out advocacy, and regulates, monitors and evaluates the works and transport sector. The works and transport sector is a cluster of priority sectors of the economy comprising public building works, road, railway, water, and air transport. In terms of mechanical engineering services, the ministry develops policies, laws, standards, and guidelines for models of vehicles for government and public use. It also provides technical advice to the government and wider public on mechanical engineering equipment. The department is headed by the Commissioner for Mechanical Engineering Services. The **Ministry of Science, Technology and Innovation** was created in June 2016 to explicitly prioritise issues related to science, technology, and innovation as key drivers for economic development. It is mandated to provide overall guidance and coordination for scientific research, development, and the whole national innovation system in Uganda.

The **Ministry of Energy and Mineral Development** aims to ensure the adequate and sustainable management and use of energy and mineral resources in Uganda.

The **Ministry of Water and Environment** is responsible for developing, managing, and regulating water and environment resources in Uganda.

69 Formally registered since 2001 as a private limited company (limited by guarantee).

70 In 2019, the organisation opened its first African country office in Uganda.

Governmental bodies

- Engineers Registration Board
- Ministry of Science, Technology and Innovation
- Ministry of Energy and Mineral Development
- Ministry of Water and Environment
- Ministry of Works and Transport

Non-governmental PEIs and engineering organisations

- Uganda Association of Consulting Engineers
- Uganda National Association of Building and Civil Engineering Contractors
- Institute of Electrical and Electronics Engineers Uganda Section
- Uganda Institution of Professional Engineers
- Engineers without Borders – USA

Main universities

- Kyambogo University
- Mbarara University of Science and Technology (MUST)
- Soroti University
- Ndejje University
- College of Engineering
- Uganda Military Engineering College
- Busitema University
- Uganda Technical College Kichwamba
- Uganda Christian University
- Kabale University
- Muteesa 1 Royal University
- Nakawa Vocational Training Institute
- Uganda Technical Colleges of Kyema, Bushenyi, Lira, Elgon and Kichwamba
- College of Engineering, Design, Art and Technology (Makerere University

National priorities

Uganda Vision 2040, the 2007-approved 30-year development vision for the country, is conceptualised around "strengthening the fundamentals of the economy to harness the abundant opportunities around the country". Among these fundamentals are infrastructure (energy, transport, water, oil and gas, and information and communications technology) and science, technology, engineering, and innovation. The vision acknowledges that for key projects to be achieved, it is necessary to "pursue policies aimed at leapfrogging, especially in the areas of science, technology, innovation, and engineering; human resource development; public sector management; and private sector development". The vision also recognises the need to "develop and implement a national science technology and engineering system that will help in initiating, importing, modifying and diffusing new technologies". The vision envisages the government to build a critical mass of engineers, especially in the oil and gas sector, to support Uganda's development aspirations.

10.0 Zimbabwe

10.1 National PEIs' relations with policymakers and supranational governance bodies

The **relationship between PEIs and government agencies** in Zimbabwe appears to be relatively strong, and indeed is what attracts industry actors to collaborating with PEIs. However, the extent to which PEIs are able to influence aspects of the policymaking process is variable. Government ministers clearly value PEIs' expertise and regularly consult them as advisors and leaders in the field. ZIE membership and operations are regulated by a private Act of Parliament (regulated by ECZ), which facilitates a more formal, legal basis for cooperation and collaboration.

PEIs have noted that, in the past 10 years, the **government has increasingly appreciated the work of PEIs** and regularly consulted them for candidates when appointing individuals to high positions, such as the secretariat. In the past year, for example, ZIE suggested two female appointments who were selected as secretaries in the Ministry for Energy and Power Development, and the Ministry of National Housing and Social Amenities. During the same period, two male engineers were elected as permanent secretaries in the Ministry of Transport and Infrastructural Development based on ZIE's recommendation, as well as other positions supporting the Ministry of ICT. ZIE has noted that the recent election of a new ZIE member and secretary in the Ministry of Local Government Public Works and National Housing will be advantageous in increasing the department's responsiveness to their ongoing advocacy efforts to **eliminate brain drain and prioritise employment of local engineers.**

As part of encouraging government to address deterioration of the nation's infrastructure over the past 20 years, ZIE has also been working directly with the ministries to shape funding priorities in the engineering industry by spearheading the development of a national scorecard. For details, see the box below.

ZIE's efforts to spearhead a national and SSA infrastructure scorecard

Since 2009, ZIE has advocated for setting up a **national infrastructure report or scorecard**. This would involve taking proactive steps to conduct primary research to supplement existing annual ZIE data to generate **lists of infrastructure gaps** for each state. The scorecard maps gaps in areas including roads, water and sanitation, energy, hospitals and clinics, schools, higher education institutions, vocational training institutions, research institutions, agriculture infrastructures, telecommunication technologies, infrastructures, and transport.

ZIE's former president was instrumental in supporting the **Infrastructure Report Project for Africa South of the Sahara**, launched by FAEO in January 2020. The objective of the project was to prepare a report on the state of infrastructure in SSA, with a view to reducing the cost and increasing the ease of producing a scorecard via the introduction of a mobile app (**Africa Infrastructure Report App**).

ZIE was central to the networking and coordination between supranational partners, including the Southern African Federation of Engineering Organisations, FAEO, and WFEO, to secure additional partners via the Commonwealth Engineers Council in Rome (2017) and London (2018).

After the launch, ZIE organised a two-day training session on the scorecard with rural council members, ministry staff, and other key stakeholders in Abuja. Approximately 50 delegates were trained on how to complete the scorecard. After the training, it was concluded that stakeholders should prioritise follow-up in terms of **assessing the level of adequacy of infrastructure**: water, sanitation, energy, roads, health, and ICT. Preliminary budgetary work was completed by ZIE in December 2020 and submitted to FAEO for review. Meetings were set up in January 2021 to discuss final aspects of budget allocation, including the implications of COVID-19 on delivery.

PEIs in Zimbabwe have demonstrated **strong links to supranational bodies** and other sister organisations, to drive stakeholder networking as well as more targeted thought leadership and knowledge dissemination. ECZ has been particularly proactive in **advocacy related to anti-corruption and ethics** via engagement with supranational governance bodies.

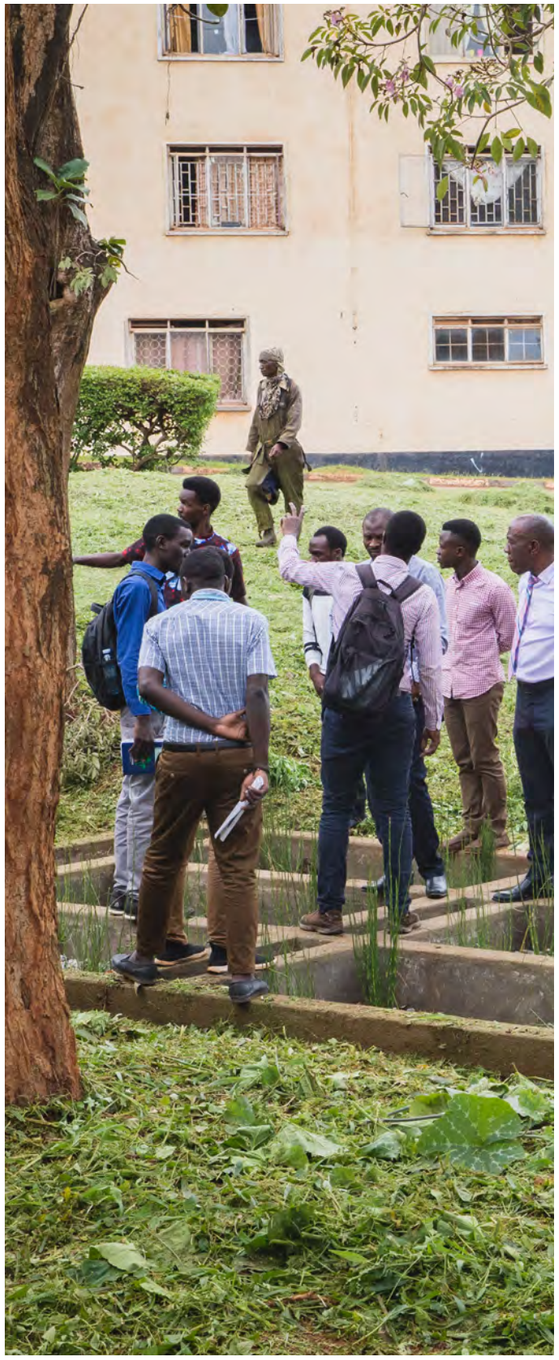
ECZ hosted and chaired the **WFEO Committee on Anti-Corruption (CAC)** for both the 2011–2015 and 2015–2019 terms. CAC's purpose is to engage the worldwide engineering community in the global efforts to fight corruption. ECZ attended and helped to organise the annual meetings of the Committee, supported the Committee Secretariat, and was involved in many of its initiatives. The total CAC budget was just over $35,000, with ECZ having funded approximately $25,000 (70% of the budget). ECZ members nominated by the WFEO Member Organisation for Zimbabwe had voting privileges for any motions put forward at CAC meetings.

In November 2020, following ECZ's proactive efforts in the anti-corruption space, WFEO elected Zimbabwe to host the **Engineering Capacity-Building and Engineering Education Standing Technical Committee**[71] for the next four years. This will involve hosting global engineering training sessions and supporting the harmonisation and integration of capacity-building initiatives focused on ethnical practice and compliance within (and, where possible, beyond) WFEO membership. This decision is in alignment with **WFEO's vision** to help developing countries to produce and enhance a sufficient pool of educated and trained engineering professionals, and to become equal partners in world trade and commerce. It also places Zimbabwe in a stronger position to achieve **signatory status to the Washington Accord** and attract wider investment and collaboration opportunities.

As mentioned on WFEO's website in reference to the Committee on Engineering Capacity Building:

"The presence of such a group of professionals could facilitate the **infusion of foreign capital** *through attraction of multinational companies to invest in that particular country, assist in making sure that foreign aid funds are appropriate as well as that these funds are applied consistently and wisely in order to transfer skills and as such build indigenous capacity to deal with engineering infrastructure, services and products."*

ZIE President Eng. Manhuwa highlighted that such an appointment is "another win for Africa and recognition for Zimbabwe [which positions] Zimbabwe to carry out our strategies for accreditation with International Engineering Alliance (IEA) and other sustainable engineering activities".



71 Zimbabwe to host world engineering education technical committee', Chronicle Zimbabwe, 12 November, 2020.

ZIE programmes

The ICT Division of ZIE successfully hosted the second edition of the 'Girls in ICT' conference in April 2019, including a dinner launch of the scholarship programme for girls in ICT. The Division of Women in Engineering has been the recipient of funding from the Royal Academy of Engineering through its agent WomEng, based in South Africa. Additionally, a series of training workshops have been carried out since August 2018, which are geared towards the empowerment of female ZIE engineering professionals, as well as making the profession a more appealing career path for girls.

ECZ has also taken a leadership role in **anti-corruption in the region**, aiming to increase the visibility of engineering and to highlight its role in sustainable development through collaboration. ECZ won a bid to host the second **UNESCO Engineering week and the World Council of Civil Engineers General Assembly** in September 2015, attracting over 500 delegates. The UNESCO Africa Engineering Week included activities focusing on ZIE's Biennial Congress, ECZ's anti-corruption workshop and the World Council of Civil Engineers General Assembly[72].

ECZ also led a GCRF Africa Catalyst-funded collaborative pilot study with CAC to produce the **Infrastructure Anti-Corruption Indices** for Zambia and Zimbabwe. The research, led by former ZIE President and current WFEO President Eng. Manhuwa, recommended the expansion of the indices into a global infrastructure anti-corruption scorecard. This will allow governments, civil society, financial institutions, professional bodies, and donors to create a "credible, measurable evidence-based infrastructure anti-corruption index, which will be one of the best tools to fight corruption[73]". ECZ collaborated with law enforcement and anti-corruption authorities and built environment practitioners in both Zambia and Zimbabwe to produce the research report.

ZIE has hosted a variety of conferences involving policymakers. The **Infrastructure Development Conference** in July 2018, for example, was a three-day event designed to engage policymakers, practitioners, and researchers in identifying solutions for leapfrogging infrastructure availability for supporting rapid economic growth, reducing poverty and inequality in Zimbabwe, and inspiring action towards change. For details, see the box on the right.

ZIE's efforts to engage policymakers through conferences

The latest annual infrastructure development conference, 'Accelerated infrastructure investment, development and delivery', was held in Victoria Falls in July 2018. The event was officially opened by President Mnangagwa, who also met privately with ZIE representatives, including the **Zimbabwe Built Environment Professionals group** comprising engineers, architects, contractors, quantity surveyors and geomatics, real estate, environmentalists, and town planners.

The conference was attended by over 350 people, including the following government speakers:

- Joram Gumbo (Minister of Transport and Infrastructural Development)
- Supa Mandiwanzira (Minister of Information Communication Technology and Cyber Security)
- Oppah Muchinguri (Minister of Environment, Water and Climate)
- Simon Moyo (Minister of Energy and Power Development)
- Mike Bimha (Minister of Industry, Commerce and Enterprise Development)
- July Moyo (Minister of Local Government, Public Works and National Housing)
- Sibusiso Moyo (Minister of Foreign Affairs and International Trade)
- Winston Chitando (Minister of Mines and Mining Development)

Some of the issues raised gained broader attention through websites such as **ZimbabweSituation.com**, which highlighted concerns, such as skill shortages among local engineers, the need to improve training for students in tertiary institutions to enhance industry attachment, and a revival of apprenticeship programmes[74].

Furthermore, a Facebook page has been set up by ZIE to **capture learning and exchange information after the conference**, as well as to promote other events, such as Women's History Month, World Engineering Day, the 2020 Global Engineering Conference, and the 2020 WFEO Executive Council Meetings. The page currently has almost 500 followers and 500 likes.

72 'Zimbabwe to host UNESCO Africa Engineering Week', News of the South, 10 August 2015.

73 A pilot feasibility study for an Infrastructure Anti-Corruption Index: The case of Zambia and Zimbabwe, WFEO, undated.

74 'Zim faces shortage of engineers', Zimbabwe Situation, 6 July 2018.

Both ECZ and ZIE have expressed the priority to become **official signatories to the Washington Accord** to ensure best standards for professional engineering accreditation and encourage development and recognition of good practices in STEM education. As a result, both are proactively working with the already accredited sister regulatory body ECSA to ensure they are following the benchmarks set out in the multilateral agreement. ZIE is mirroring the same accreditation process as ECSA as it moves towards this objective.

As part of its efforts to run a fully **functional accreditation scheme**, ECZ works collaboratively with engineering programmes at regional level, led by ECSA. It attends meetings and conferences on accreditation, and submits abstracts and presentations for assistance schemes delivered by ECSA. ESCA has consequently offered to be ECZ's mentor in preparing for joining the Washington Accord and regional engineering programmes.

The challenges of engaging with national policymakers/supranational bodies

While a good working relationship exists between PEIs and national policymakers, **PEIs' influence is somewhat variable**, and contingent on the mitigation of a number of challenges, as detailed below.

Limited influence of the local engineering workforce

Following the global financial crisis in 2008, many businesses in Zimbabwe, particularly in engineering and manufacturing, had to close or significantly scale down. **Zimbabwe was one of the worst-affected countries** in Southern Africa, and hyperinflation led to various economic sanctions, political instability, and mismanagement. Most notably, manufacturing companies struggled to produce and provide services competitively, to export and to substitute imported raw materials. They were also unable to produce affordable local products for use by Zimbabweans.

As a result of this crisis, from 2009 to 2014, there were **fewer opportunities for industrial attachment for engineering graduates** (an essential aspect of practical learning for students and new graduates), and many qualified engineers sought work in other countries or with international companies to develop these practical skills. For larger, more lucrative projects, such as engineering work on Parliament buildings, workers were typically sourced externally, reducing opportunities for Zimbabwean engineers to gain essential industry knowledge and practical experience.

Furthermore, some PEIs reported that there is still a perception in society that engineering is not an 'essential' and highly respected job, so during periods of economic malaise, vocational training for engineers is not prioritised in terms of job creation.

These issues are being directly tackled by WFEO through the Committee on Engineering Capacity Building, which focuses on capacity-building ventures to spark interest and commitment in engineers within their own communities.

Lack of advocacy training for engineers

Related to the above, the absence of regular opportunities to work with industry also inhibits the ability to gain soft skills for negotiation in policymaking or other decision-making contexts. In order to influence decision-makers and public behaviour and to manage ministerial expectations, engineers need to have a confident grasp of the practical challenges of engineering. Only then can they fully 'sell' the unique value proposition of engineering solutions in the context of policy design and implementation.

The ZIE Women's Chapter is one example of an initiative that may help to tackle this issue, in part through simply increasing the visibility of female engineers in the policymaking space and in industry. This is achieved through mentoring young female students who visit government ministries and observe, or contribute to, negotiations during key meetings or conferences.

Limited financial and staff capacity

Both of the main PEIs reported that **capacity and human resources were notable challenges** that limit expansion and, specifically, advocacy. ECZ is currently without a fully functioning office. Because of its reliance solely on membership fees and its unsuccessful attempts to secure government funding, there is currently not enough budget to focus on issues outside the immediate priorities of delivering existing work and improving the accreditation process.

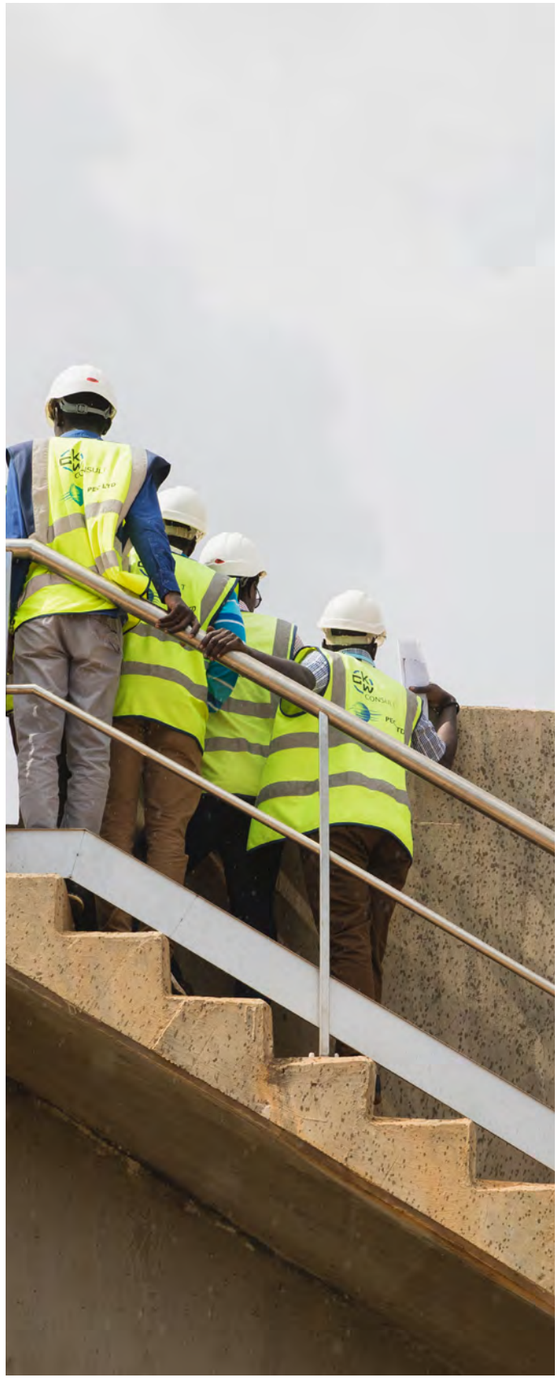
For instance, committing resources to advocacy across the eight faculties of the University of Zimbabwe (overseen by ECZ) would require specific training in a variety of areas, such as **negotiation in policymaking, additional recruitment, and restructuring.**

Furthermore, work would have to be done to universally understand the value proposition of specific types of engineering offers, and how to tailor and promote them to specific government departments.

Conflicting priorities and variance in responsiveness of government departments

Political priorities not only shift with election cycles, but are also sometimes contradictory between departments. Without meaningful multisectoral collaboration and influence, PEIs' ability to influence policymaking is a 'hard sell' because of the following factors:

- Government ministries are **battling multiple priorities**, whereby issues without the backing of other sectors or highly influential actors within engineering are unlikely to receive attention.
- PEIs appear to be **competing with other more influential private sector actors** which are offering similar services or solutions, and which may already have caught the government's attention. Because of limited resources, the government understandably does not want to duplicate efforts unless it is confident in the added value bought by PEIs' offer.
- There is a **variance in culture and responsiveness** between government departments. PEIs have reported that some government departments are more open to engagement and collaboration than others. For example, Ian Mutamiri from Purple Future Trust noted that the non-profit sector typically receives a very good reception from the Ministry of Science and Technology because they "speak the same language". The Ministry is more welcoming because it is already aware of the priorities in ICT. The Ministry of Education, however, is facing different pressures and looking to other industries for expertise. This means engineering or STEM bodies are less influential, particularly if (as mentioned above) engineers themselves have not grasped the unique value of what they are trying to 'sell'[75].



75 Challenges and opportunities in implementing engineering systems thinking in design, manufacturing and process industries in Zimbabwe, Nyemba, W.R. and Mbohwa, C., December 2017.

10.2 PEIs' relations with industry

PEIs' engagement with the private sector is somewhat variable. Industry actors have now taken to advertising for positions through ZIE (including via Facebook), and ZIE reports that it tries to encourage only those who are registered with ECZ to apply. Large contracts from government or parastatals are also advertised through ZIE, stipulating the same conditions. This helps to protect local professionals and also encourages engineers to be members of ZIE and to register with ECZ.

The COVID-19 pandemic has presented a key opportunity for further collaboration through ZIE's project **Zimbabwe Built Environment Professionals Trust (ZBEPT)**, a community of professional bodies that includes ECZ, ZIE, the Zimbabwe Association of Consulting Engineers, the Architects Council, the Institute of Architects, the Zimbabwe Institute of Quantity Surveyors, the Project Management Institute Zimbabwe, the Zimbabwe Building Contractors Association, and the Construction Industry Federation of Zimbabwe. ZBEPT focused on developing a COVID-19 community isolation centre in the final quarter of 2020 to ease the pressure on existing isolation facilities in the country. Further detail is included in the box below.

ZBEPT joint collaboration with private sector during COVID-19

Recognising the funding requirements for this venture, a key part of ZIE's concept note is direct engagement with individuals, companies, international finance institutions, development banks, and other donors to support the development of the facility. It is recognised that for this effort to be effective and sustainable, it will require policy, regulatory, management and health-related technical expertise.

The project seeks to **work collaboratively with the private sector in crisis management** to achieve the following objectives:

- increase the number of COVID-19 isolation beds in Zimbabwe by 400 before the end of 2020
- provide a safe environment and a facility, in line with World Health Organization standards, for professional monitoring of COVID-19 patients before the end of 2020
- add to the existing health infrastructure in the country and help to achieve Sustainable Development Goal 3 of the United Nations
- relieve pressure on other hospitals by releasing 400 beds in other Harare hospitals for treatment of non-COVID-19 patients before the end of 2020
- provide a template for other COVID-19 isolation facilities in the country
- minimise project costs by offering pro bono services by ZBEPT professionals in collaboration with other similar-minded professional organisations.

ZIE has developed a concept paper for this proposition, which it recently uploaded on its website. If the proposal is approved, the facility will be driven by the private sector (in Harare's surrounding provinces of Mashonaland East, Mashonaland West, Mashonaland Central, and the dormitory town of Chitungwiza) to mobilise professionals and other service providers in the construction industry to offer their services pro bono. Other service providers and stakeholders will be approached on an ad hoc basis, depending on the needs that evolve in the early implementation of the centre.

As of January 2021, ZIE has not yet received a formal approval letter from the government, which it requires in order to formally engage private actors for investment and to recruit local and regional experts. ZIE has confirmed that it has identified interested donors who are prepared to collaborate, but without approval from the government they are unable to move forward.

PEIs and academic bodies also work jointly on **facilitating the transition of young graduates into industry,** often hosting conferences or learning events with university departments tailored to particular industry needs. The legal requirement for all practising engineers to be registered with ZIE has created an increase in student and graduate membership as they prepare to transition into industry and register with ECZ.

ZIE holds annual competitions (in conjunction with tertiary institutions) to promote the practice of engineering and encourages students and graduates to participate. At such competitions, industry is always represented and seeks to **identify potential graduate engineers to work in engineering companies.**

For example, ZIE and the University of Zimbabwe (Department of Mechanical Engineering) jointly hosted an engineering conference in November 2016[76]. The purpose of the indaba was to **bring together stakeholders to discuss issues affecting the country's economy** and to develop solutions focused, in particular, on the small-scale mining sector. The indaba started with a presentation from civil engineer and ZIE member Munyaradzi Meki on the road traffic signs and signal regulations of the Southern African Development Community. The aim of the presentation was to agree on a protocol for more harmonised, roadworthy requirements, loading requirements, and many other aspects of transport and traffic.

The challenges of working with industry

Despite PEIs' attempts to engage with the private sector, there are a number of practical challenges to making this work in reality, as well as several **perceived barriers to partnerships between PEIs and industry** that need to be understood and addressed.

In order for companies to make cash investments in joint projects, clear incentives must be in place. As with engagement with the higher education sector, **private investors need to see clear strategic and financial benefit** for them to 'buy in' and support joint implementation of a project or initiative.

Drawing on data from 50 companies and 37 institutions of higher and tertiary learning in Zimbabwe, the main incentives for partnering are recognition (45.1%) and research property rights (15.7%), followed by rights to purchase the name of a facility or event, reduced costs for use of facilities, and granting of a patent by the state. It appears there may be a **lack of industry awareness** of how partnerships with PEIs can add value to their own strategic priorities[77].

In terms of perceived barriers, there are clear **differences between PEIs and companies** when it comes to culture, bureaucratic structure, resource capacity, and funding mechanisms. Some PEIs feel that the for-profit model may not be compatible with the evidence-based approaches needed to address key infrastructure or public health solutions. Equally, PEIs' flexibility may be compromised if they are relying on a committee system whereby decision-making may be slower than in private organisations. The working relationship between industry and PEIs is, therefore, partly hindered by **differences in workflow and bureaucratic processes.**

76 'Zimbabwe Institute of Engineers, University of Zimbabwe host joint Engineering Indaba', Construction Review Online, 4 December 2020.

77 Public–private partnerships (PPPs) between industry and institutions of higher education in Zimbabwe, Chanakira, M., September 2013.

10.3 PEIs' relations with academia

Relationships between PEIs and universities are well established and typically centred around the **improvement of engineering courses and facilities.** Tertiary institutions in Zimbabwe operate on the basis of an Act of Parliament.

The accreditation of all programmes at tertiary institutions is the responsibility of the **Zimbabwe Council of Higher Education (ZIMCHE)**, which works very closely with ECZ on engineering programmes. ECZ also works very closely with the other engineering councils in southern Africa to standardise curricula, and to facilitate the mobility of engineers to work anywhere in the region, including internationally. Furthermore, ZIE's Board comprises standing members from universities with engineering faculties (such as Dr Eng. William Goriwondo and Dr Eng. Muredzi Perkins), polytechnics with engineering departments (Dr Eng. Tafadzwa Mudondo), and research institutions (Eng. Koza Tirivangani).

ZIE also plays an instrumental role as a **'go-between' for industry and academia.** Firstly, **CPD courses** that are required for annual registration are usually offered by engineering academics at tertiary institutions. These have to be approved by ZIE to be recognised for the accumulation of CPD points.

Secondly, the industry has provided **specialist training of engineering academics and students** through programmes, such as Visiting Professors or Adjunct Professors, that are engaged by universities on a temporary basis for short periods of time to offer these specialist courses.

As confirmed by Dr Eng. Nyemba, Dean of Engineering at the University of Zimbabwe, on several occasions ZIE has also organised or co-organised **motivational talks by industry players** to encourage students to stay within the profession. For details of ZIE's partnerships with Zimbabwe Open University, see the box below.

ZIE's technical partnerships with Zimbabwe Open University

ZIE has formed a technical partnership with the faculties of Agriculture and Technology at Zimbabwe Open University and The Diaspora Engineers. This partnership focuses on providing opportunities for practical, hands-on training, theory-based short courses, and long-term jobs for local engineers. It is also designed to help graduates with business ventures throughout the country. The various projects are provided on the University of Zimbabwe's website, and focus on two key areas:

- The development of practical entrepreneurial skills and industry critical skills that are competitive in both the national and global labour market. This specifically relates to the Education 5.0 policy, adopted by the Ministry of Higher and Tertiary Education, Science and Technology Development. The policy requires universities to work with local communities to identify economic opportunities to not only inform their curriculum trajectory but also the innovation research and development agenda
- To support the reigniting of closing or closed industries, training will be focused on innovation of new industries and 'low-hanging fruit' (such as the production of mass goods, which have capacity to be exported for foreign currency revenue generation and also for domestic consumption)[78].

Furthermore, since 2014, with the financial backing of the Royal Academy of Engineering, ECZ has helped young lecturers to gain industry experience via **six-month placements** that allowed them to develop key practical and theoretical knowledge of engineering before returning to teaching full-time. This was implemented successfully using the University of Zimbabwe as a hub. In total, there were eight institutions (including in Malawi, Mozambique and Botswana) attached to each hub.

ZEI also led **bridge-building competitions** where secondary and university students compete at regional and national level against neighbouring countries. These competitions aim to help contextualise the profession and understand how essential the profession is in the wider society. In many competitions for students in their final year of university, there is a thematic focus on cross-sectoral work to address how engineering delivers sustainable solutions for clean water, access to health services, and improved agricultural practices, including via ICT and innovative technological solutions.

78 The Zimbabwe Open University website.

National engineering and science competitions for students have now become highly esteemed, and PEIs confirm that these are a genuine opportunity for students to discuss and solve real issues that challenge the economy.

10.4 PEIs and the media

Zimbabwe PEIs are well established on **traditional forms of media, such as television and radio**, and have expanded their online reach by regularly updating their websites and social media.

ECZ, for example, confirms that it often seeks to **promote awareness of the role of engineers** and the importance of engineering for society. ECZ Chief Executive Officer Dr Sinzan Diarra often features on national TV broadcasts where members of the public phone in to ask questions about engineering, and how they can become members of ECZ and ZIE. ECZ has also been proactive in setting up stands at various public events, such as Zimbabwe's Agricultural Show and the Zimbabwe International Trade Fair, which both receive media coverage on the television.

While ZIE has struggled to find funding and capacity to justify recruiting a communications officer, it is currently working on a draft protocol expected to be implemented within the first few months of 2021. In November 2020, ZIE held a meeting with its communications team to agree on the **recruitment of a communications intern.** Due to COVID-19, these plans have been put on hold, but are in the pipeline for when ZIE reopens on 3 February 2021.

In terms of **online presence**, both ECZ and ZIE have regularly updated websites and social media pages (Facebook, Twitter, and LinkedIn). ECZ's website includes detailed information about the membership and registration process, the history of ECZ and relevant partner information, details about ECZ's CPD programme, the latest news and notices, and a complaints page.

ZIE's website also includes organisational information, details of membership, CPD and training, as well as a publications section for press releases and newsletters. ZIE produces the ***Journal of Science, Engineering and Technology*** **e-Newsletter**, and the quarterly magazine ***The Zimbabwe Engineer*** (which is publicly available on its website, as well as on ResearchGate).

On Facebook, ZIE regularly promotes job vacancies, key conferences, and virtual learning events from both national and supranational organisations, including WFAO. ZIE often includes the contact details of the Membership Services & Training representative, who plays a key coordination role in many of these events.

PEIs have reported that **e-learning platforms and Zoom seminars** have generally been very successful ways of reaching out to a variety of industry stakeholders, and generating interest in seminars, workshops and other learning events during the COVID-19 pandemic. This has allowed industry players to remain connected to the work of PEIs and identify opportunities for potential collaboration.

PEIs are also seeking opportunities to **promote ideas and thought leadership** through well-established websites (and, subsequently, through Twitter and Facebook). For example, the Chair of ZIE, Eng. Jacob Kudzayi Mutisi, wrote an article for TechZim.com about the underdevelopment of digital media for government and parastatal websites, the thriving ICT sector in Zimbabwe, and the rationale for bringing together the government and the private sector to find modern ICT solutions to increase visibility and promote knowledge dissemination[79]. Eng. Mutisi's article was targeted at the Ministry of Media, Information and Broadcasting Services to encourage transfer of ICT skills from the private sector to public bodies. The article concludes that "there is now a need for Zimbabwe's government to have a development agenda that turns towards inclusive growth, creating an environment where there is participatory decision-making that brings together the government and the private sector in finding ICT viable solutions to...basic challenges[80]."

However, there remains room for improvement regarding PEIs' online presence and the use of more modern forms of media beyond email lists, websites and TV and radio.

79 'Zim government 25 years behind private sector when it comes to web presence', TechZim, 3 April 2019.

80 ibid.

10.5 Appendix: overview of key engineering stakeholders and priorities in the country

Key stakeholders

The key PEIs in Zimbabwe include ECZ; ZIE; the Zimbabwe Association of Consulting Engineers; the Architects Council of Zimbabwe; the Institute of Architects of Zimbabwe; the Zimbabwe Institute of Quantity Surveyors; the Zimbabwe Building Contractors Association; and the Construction Industry Federation of Zimbabwe. The two main PEIs are ZIE and ECZ.

ECZ is responsible for issuing practising certificates, providing accreditation of courses to registered people, and ensuring that constituent bodies have adequate procedures to enforce ethical practice and discipline among engineers and technicians registered under the Engineering Council Act.

ZIE is a multidisciplinary professional organisation of engineers with graded membership. It holds a similar mandate to ECZ in terms of setting and maintaining appropriate standards of engineering and technical competence and ethics, and promoting the advancement of engineering and relevant knowledge dissemination. ZIE membership must be gained as a prerequisite before engineers can proceed to register with ECZ and obtain a practising licence.

At government level, the key actors in the development of engineering-related policy and regulation are: the Ministry of Transport and Infrastructural Development; the Ministry of Local Government Public Works and National Housing; the Ministry of Higher Education, Science and Technology; the Ministry of Agriculture; the Ministry of Public Works; the Ministry of Environment; Water and Climate; the Ministry of Energy and Power Development; the Ministry of Health and Child Care; the Harare City Health Department; and the Environmental Management Agency. Each local government authority has by-laws that regulate standards in engineering, and respective state authorities are responsible for supervising engineering and construction projects according to regulatory requirements for each site[81].

The main academic stakeholders include the School of Engineering and Technology, Harare Polytechnic College, and the Faculty of Industrial Technology at the National University of Science and Technology.

Grassroots engineering-focused organisations are also working, to varying degrees, with academic institutions, PEIs, and government stakeholders to deliver educational programmes in engineering. Purple Future Trust, for example, is a non-profit organisation which delivers programmes and ad hoc events with the aim of empowering socially and economically disadvantaged communities in STEM education. Purple Future Trust works with PEIs on both contractual and non-contractual bases, and often functions as a key coordination point for sizable learning and dissemination events, such as Africa Science Week and various hackathons.

There are also a number of **private organisations** that engage in partnerships and affiliations with engineering institutions and the government. For example, there are over 100 private companies listed on ECZ's website, which provide various engineering solutions across multiple sectors, including manufacturing, transport, agriculture, electricity, water and sewage disposal, mining, communications, and retail.

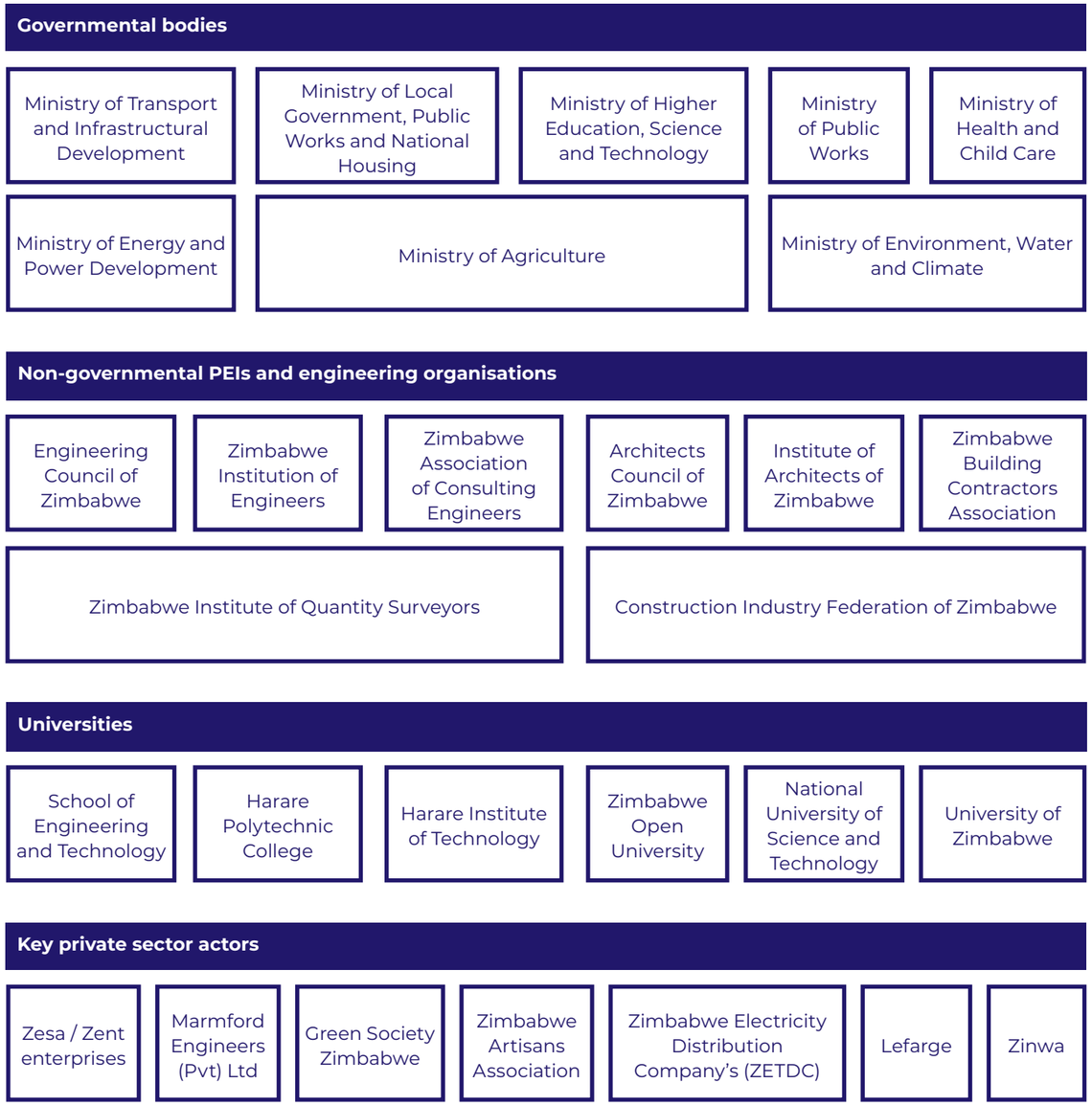
One key private actor is **ZESA Enterprises** (also known as ZENT), which is a wholly owned subsidiary of ZESA Holdings, along with ZPC, ZETDC and Powertel. ZENT provides engineering solutions to the electricity sector through its four operating divisions: manufacturing, projects, transport, and retail.

Similarly, **Marmford Engineers** provides electrical and mechanical engineering services to a wide variety of industrial and commercial clients. Among other services, the company provides pumping systems to municipalities and large government buildings. It also provides and installs equipment such as distribution boards, electrical switchgear, and motor control centres.

The two key partners that are documented as formally affiliated with ECZ are the **Green Society Zimbabwe** and the **Zimbabwe Artisans Association**. TelOne, Zinwa, ZETDC, PPC and Lefarge are partners to ZIE.

81 Construction and engineering laws and regulations, ICLG, 11 August 2020.

Figure 10.2: Overview of the key engineering stakeholders in Zimbabwe



National priorities for engineering

One key focus for the government is the Science, Technology and Innovation Policy of Zimbabwe, which was launched in 2012 with the help of UNESCO and the African Technology Policy Studies Institute. The policy seeks to mainstream STEM education, technology and services in an equitable fashion, and promote institutional links between STEM organisations and stakeholders. The policy aims to secure high standards in key aspects of infrastructural development, such as functional science laboratories in all schools, universities and related research and training institutions; modern ICT in institutions to ensure competitiveness; and 'centres of excellence' in various disciplines of science and technology at tertiary and research institutional levels.

Annex II: references

Nigeria

Interviewees

- Alex Okopi Momoh, Executive Secretary, NSE

Resources

- APWEN National Conference 2020 – Press Conference, APWEN HQ TV 27 September 2020
- 'COREN seeks public, private sector support for quality infrastructure', Vanguard, 28 October 2020
- 'Government policies and engineers' roles in facilitating Nigeria's transition to circular economy', Dunmade, I.S. et al, Journal of Physics, 2019
- How PEIs can best collaborate with key stakeholders – including policy makers, NIMechE FAFME Project Office, 26 November 2020
- 'NAE spotlight', NAE, undated
- 'The engineer's role in public policy', Denny, F.I, Robinson, R.L, 2003 The APWEN Facebook page
- The NSE Facebook page

Sierra Leone

Interviewees

- Tani Pratt, Chair of the Sierra Leone Professional Engineers Registration Council
- Trudy Morgan, President of the SLIE
- Sybil Kunle Harleston, Technical Director of Edward Davies & Associates Ltd

Resources

- 'African solutions to the coronavirus crisis', BBC News, 22 May 2020
- 'Assuring Quality Higher Education in Sierra Leone by FCDO', SPHEIR project, undated
- 'Capacity training for young engineering graduates', Concord Times, 16 March 2017
- Evaluating the case for cash transfers of resource revenues in Sierra Leone, Nair, A., May 2012
- 'Green cover over western area using satellite imagery' DSTI, undated
- 'How a higher education reform partnership in Sierra Leone is adapting to COVID-19 restrictions', SPHEIR project, 24 July 2020
- 'How can we help students develop the skills that employers and society really need', SPHEIR project, 15 December 2020
- International Engineering Education Conference, SLIE, 24 September 2018
- National Energy Efficiency Action Plan, Ministry of Energy, 30 July 2015
- 'No pot of gold for locals as China mines Sierra Leone', Reuters, 22 August 2019.
- 'Phase 2 projects', Royal Academy of Engineering, undated
- 'Political Economy of Extractives Governance in Sierra Leone' World Bank, July 2013
- 'Seeding Innovation in Sierra Leone', Tony Blair Institute for Global Change, 20 July 2018
- 'Sierra Leone awaits the arrival of Manor River Union electricity', Sierra Leone Telegraph, 26 May 2020
- Sierra Leone: Economic development documents – National Development Plan, 2019–23, International Monetary Fund, 9 June 2019
- 'Sierra Leone Institution of Engineers and Professional Engineers Registration Council Pay Courtesy Call on President Julius Maada Bio', State House Media and Communications Unit, 31 January 2019
- 'Sierra Leone's water minister Tengbe appeals for international help', Sierra Leone Telegraph, 27 June 2018
- 'SLIE and PERC Investigate Causes of Savage Street Bridge Collapse', SLIE, 21 September 2020
- 'Team', DSTI, undated
- The PERC website
- The SLWE website
- The WFEO website

South Africa

Interviewees

- Dr Ron Watermeyer, Trustee, Engineering Against Poverty

Resources

- About us, BBCBE website, undated
- Annual report 2018/19, ECSA, August 2019
- The CESA website
- Client guide for improving infrastructure project outcomes, Watermeyer, R., April 2018
- ECSA's website
- Engineering advice on addressing post COVID-19 challenges, Goba, T. T., 27 May 2020

- 'Engineering professions ready to assist in power supply solutions', Crown Publications, 19 February 2019
- The IMESA website
- National Digital and Future Skills Strategy, Department of Communications and Digital Technologies, 23 September 2020
- 'PPS launches Inner Circle student lounge', BizCommunity, 30 July 2013
- 'Professionalising the state is the only way to develop infrastructure', Campbell, C., 2 December 2020
- Public infrastructure delivery and construction sector dynamism in the South African economy, Watermeyer, R, and Phillips, S., 25 April 2020
- Recognised Voluntary Associations, ECSA, 31 July 2020
- The SAAE website
- Young Contractors Forum, SAFCEC, undated
- Young Professionals Forum, CESA, undated
- An overview of professional engineering institution activities in sub-Saharan Africa: Main challenges and initiatives. Report to the Royal Academy of Engineering, Ecorys UK, undated
- GCRF Africa Catalyst: Capacity-building of Professional Engineering Institutions in sub-Saharan Africa, Annual report 2018–2019, Ecorys UK, undated
- PEI networks in Southern, Eastern and Western Africa: A mapping exercise. Report to the Royal Academy of Engineering, Ecorys UK, January 2019

Uganda

Interviewees

- Eng. Dr Florence Lubwama Kiyimba, ERB (Vice Chair), Uganda Institution of Professional Engineers (Board Member)
- Eng. Ronald Namugera, Registrar, ERB
- Eng. Vincent Ochwo Olie, former President, UIPE
- Mike Serunkuuma, Projects Officer, UNABCEC

Resources

- About the Ministry, Ministry of Water and Environment, undated
- About us: Mandate, Ministry of Energy and Mineral Development, undated
- An overview of professional engineering institution activities in sub-Saharan Africa: Main challenges and initiatives. Report to the Royal Academy of Engineering, Ecorys UK, undated
- Annual report 2019, UNABCEC, undated
- *'Court clears changes in REA', Etukuri, C., 18 June 2020
- *'Engineers back govt plan on infrastructure', Bwambale, T., 28 June 2020
- 'Engineers caution against Karuma commissioning', Ojon, R., 3 December 2020
- 'Engineers decry lack of gov't support', NTV Uganda, 04 July 2019
- 'Engineers push for enactment of UCICO Bill to halt building disasters', Ninsiima, C., 27 April 2016
- 'Engineers' board trashes approved cities as slums', Daily Monitor, 6 June 2019
- 'Exposure of quack engineers protects public from disaster', Kiyonga, D., 2 August 2020
- FIDIC Africa website, undated
- 'Govt must rescue construction sector', Muhebwa E., 1 July 2020
- *'Govt officials, Sinohydro to meet as Karuma dam contract expires today', Emorut, F., 30 November 2020
- IEEE Uganda Section Facebook page
- 'Local contractors' capacity building: a call for government intervention', Muhebwa E., 4 September 2019
- 'Local firms should take on city projects', Muhebwa E., 2 December 2020
- 'Museveni's Rejection of National Local Content Bill Sparks Fire Storm', Kimathi, D., 2 October 2020
- MRA for engineers in EAC. Opportunities for Engineers in the EAC Region, Eng. James Okiror, 2014
- *'NCHE cautions universities on uncredited engineering courses', Mubiru, A., 12 March 2019
- *'Over 8000 engineers not registered', Lule, J. A., 24 July 2019
- 'President Museveni declines to assent to PPDA amendment bill', The Independent, 15 July 2020
- Progress on the implementation of the Reservation Scheme to promote local content in public procurement, The PPDA, 22 January 2020
- Regulation of the Construction Sector by Ministry of Works and Transport, A Report by the Auditor General, Muwanga, J. F. S., 31 December 2015
- 'Stanbic Bank supports local contractors to promote infrastructural development', Ivudria, G., 17 December 2019
- The Engineer, Issue 4, ERB, 2019, p. 10
- The Contractor, Issue 13, UNABCEC, 13 September 2019
- The Contractor, Issue 14, UNABCEC, 14 January 2020
- 'The National Local Content Bill 2019', The Uganda Gazette, No.4, Volume eX/I, 25 January 2019
- UACE Newsletter 2020, UACE, February 2020
- Uganda Vision 2040, National Planning Authority, 2007
- UIPE Newsletter July–September 2020, UIPE, 16 October 2020
- UNABCEC Facebook page
- 'UNABCEC Graduate Training Program', UNABCEC, undated
- 'UNABCEC partners with NCBA Bank to support growth of construction industry', Matovu, M., 11 December 2020
- 'We are not being given gov't contracts – engineers', NTV Uganda, 09 June 2019
- 'We have capacity for big national projects - local contactors', NTV Uganda, 15 June 2019
- 'Who is to blame for collapsing buildings?', Daily Monitor, 28 January 2020
- GCRF Africa Catalyst: Capacity-building of Professional Engineering Institutions in sub-Saharan Africa, Annual report 2018–2019, Ecorys UK, undated
- PEI networks in Southern, Eastern and Western Africa: A mapping exercise. Report to the Royal Academy of Engineering, Ecorys UK, January 2019

Zimbabwe

Interviewees

- Ian Nyasha Mutamiri, Co-Founder, Purple Future Trust
- Dr Sinzan Diarra, Chief Executive Officer, Zimbabwe Institution of Engineers (ZIE)
- Dr Nyemba, Dean of Engineering, University of Zimbabwe

Resources

- 'A pilot feasibility study for an Infrastructure Anti-Corruption Index: The case of Zambia and Zimbabwe,'' WFEO, undated.
- 'Challenges and opportunities in implementing engineering systems thinking in design, manufacturing and process industries in Zimbabwe', Nyemba, W.R. and Mbohwa, C., December 2017.
- Construction and engineering laws and regulations, ICLG, 11 August 2020.
- 'Ground breaking diaspora engineers body formed in UK', New Zimbabwe, 29 November 2019
- 'Public Private Partnerships between Industry and Institutions of Higher Education in Zimbabwe', M. Chanakira, 2013
- ''Project CARE reusable face mask', Purple Future Trust, undated.
- The Zimbabwe Open University website
- 'Zim government 25 years behind private sector when it comes to web presence', TechZim, 3 April 2019
- 'Zim faces shortage of engineers', Zimbabwe Situation, 6 July 2018.
- 'Zimbabwe Institute of Engineers, University of Zimbabwe host joint Engineering Indaba', Construction Review Online, 4 December 2020.
- 'Zimbabwe to host world engineering education technical committee', Chronicle Zimbabwe, 12 November, 2020
- 'Zimbabwe to host UNESCO Africa Engineering Week', News of the South, 10 August 2015.

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

TALENT & DIVERSITY

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

INNOVATION

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

POLICY & ENGAGEMENT

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.