

# ENGINEERS FOR AFRICA

Identifying engineering capacity needs  
in Sub-Saharan Africa

Supporting document 3:  
Analysis of stakeholder interviews



### **About the Africa-UK Engineering for Development Partnership**

The Africa-UK Engineering for Development Partnership (A-UK) brings together the engineering community in Africa and the UK in a consortium comprising the Africa Engineers Forum, The Royal Academy of Engineering, the Institution of Civil Engineers and Engineers Against Poverty. The aim of the Partnership is to strengthen the capacity of the African engineering profession and promote mutually beneficial links between engineers in Africa and the UK.

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## 1. Introduction

This document summarises key themes from interviews carried out with professional engineers and decision-makers who work in, or rely on, the engineering sector in sub-Saharan Africa (SSA). Most of the interviews were carried out either in person in the UK or by telephone to countries in SSA and two were carried out in Zimbabwe. The interviews complement a literature review and an electronic survey, and the three parts are brought together in the Research summary report. Interviews were semi-structured with all interviewees being asked for their experiences and views in relation to engineering capacity needs, the impact of any engineering capacity deficiencies and potential capacity building strategies in SSA.

Fifteen people were interviewed in total. Five of these were Nigerian (three of which were based in Nigeria and two were active members of the diaspora, based in the UK). Of the remaining ten interviewees, two were from Zimbabwe and one from each of Kenya, Zambia, Botswana and South Africa (those based in Botswana and South Africa were not from these countries but had lived there for many years). Three further interviewees were of British origin, but had extensive experience of working in Africa, one of them predominantly in Tanzania. The final interviewee had worked on engineering projects in west, southern and east SSA, and was working for the World Bank in the USA at the time of the interview.

All of the interviewees were men, and there was a strong bias in the sample towards civil engineers as twelve of the interviewees were civil engineers or working in the civil engineering sector. This reflects a bias in the literature review and electronic surveys towards civil engineering. Seven interviewees were managing directors of civil engineering consultancies (six in SSA, one in the UK but with many links with Nigeria). The exceptions were one manufacturing engineer, one electrical engineer and one from the mining sector.

The majority of interviewees were 'decision-makers', that is, people in senior positions who rely on and engage with engineers. In addition to the seven managing directors of civil engineering companies, the sample included the CEO of a multinational mining company working in Tanzania, three donor consultants, two academics (only one of whom was based in an African university, in Kenya) and one elder statesman who worked for the Nigerian Federal Minister for Works and Housing from 1967 to 1974. Interviewees from Zambia, Zimbabwe, Botswana and Nigeria were past presidents of their local professional associations. The sample used here is by no means representative of the engineering community across the entire SSA region. However, this group was selected on the understanding that the individuals' experiences gave them broad insights into the engineering sector, at various levels, that will complement the more numerous and varied survey responses.

A number of points of consensus emerged from the interviews. This document provides a summary of the key points that emerged and is arranged thematically. It begins with a short overview of the nature of skills shortages and the causes of those shortages are then discussed in detail. This is followed by the interviewees' perceptions of the impact of lack of capacity in the engineering sector on development. Next is a summary of the views of interviewees on approaches to building capacity and the final section draws overarching conclusions.

## 2. The nature of capacity needs

All interviewees stated that they believed the engineering sector in SSA lacked capacity. A variety of problems emerged in the interviews that were captured by the broad term 'lacked capacity'. These included scarce skills, where there were not enough engineers to meet demand. According to the South African interviewee, for example,

*"there are a lack of numbers [of qualified engineers], there's no doubt about that".*

They also included skills gaps, where qualified people were available but they did not have the required experience. Interviewees with experience in Nigeria, Zambia, Zimbabwe and Botswana expressed the opinion that the principal problem was a shortage of engineers with the needed skills rather than a shortage of engineers *per se*.

Each of these interviewees suggested that while employers struggled to find engineers who fulfilled their requirements, engineering graduates still struggled to find employment. The Dean of Engineering at a Kenyan university explained that although there was a "very big shortage of engineers" in Kenya, he did not support a recent general drive to increase the numbers of students that studied engineering, as greater numbers of engineers were only required in particular industries. As well as the varying demand across different engineering sectors, it was also noted by some interviewees that there were different capacity issues across the spectrum of engineering levels (ranging from technicians to senior managers).

The interviewees highlighted a number of problems that resulted in these capacity issues. These included, on the supply side, difficulties in attracting and retaining high quality engineering graduates in engineering sectors. On the demand side, there could be insufficient resources, networks (especially partnerships between industry and academia) and flow of projects to provide appropriate opportunities for engineers to acquire skills and experience. These underlying factors are discussed in detail below.

## 3. Causes of low capacity

This section is separated into five themes. It starts by discussing how the nature of global markets and the 'brain drain' phenomenon perpetuate skills shortages among local engineers. The following four headings discuss the extent to which lack of capacity can be attributed to the performance of a range of key engineering sector stakeholders. These are tertiary education institutions (universities and technical colleges), the private sector, professional engineering institutions and other professional bodies and policymakers.

### a) The nature of global markets and the 'brain drain' phenomenon

Several interviewees pointed to the problem of foreign companies taking on large infrastructure projects in SSA and failing to transfer knowledge to local engineers. Capacity building had become even more challenging in recent years due to the fact that markets for works and services were increasingly global. Fierce competition from engineering firms in emerging economies – particularly China – had led to national engineering firms losing out on contracts, and thus on opportunities to learn.

It was suggested that works carried out by Chinese contractors were often also funded by the Chinese government. These contracts were effectively 'tied aid', where a condition of the grant or loan was that a Chinese contractor would carry out the works. However, it was explained that even in open tenders the Chinese offered very competitive rates, as they were able to draw on very cheap, highly qualified people from their own countries or from other parts of the world. While several interviewees stressed that Chinese investment was welcome, they also expressed the view that the Chinese mode of operation left little room for skills and knowledge transfer to locals. This was blamed, in part, on language and cultural barriers and the tendency for Chinese contractors to work in a self-contained way.

Interviewees from Nigeria and Zambia expressed frustration that, due to the nature of the globalised economy and the political drive to develop at any cost, governments did not compel foreign firms to train locals or enforce quotas for the employment of national staff.

Globalisation, it was argued, had also altered the nature of labour markets. The increased mobility of labour, combined with the global shortage of engineering skills, had resulted in the phenomenon of brain drain, whereby local engineers who had managed to acquire marketable skills migrated to other countries, where they were able to earn more and experience better working conditions. This was identified by several interviewees as a key challenge for the engineering sector. The phenomenon created strong disincentives to train engineering staff, as the better trained they were, the more attractive they became in the global market, and thus the more likely they were to leave. At the same time, it was noted that those who have studied abroad were often reluctant to return.

The brain drain phenomenon, according to a number of interviewees, extended to sectors as well as countries. Sectors such as finance, banking, insurance, IT and management consultancy tended to pay better than engineering, and hence attracted engineering graduates away from engineering sectors.

One interviewee highlighted that even highly paid engineering sectors could experience the same problem. The president and CEO of an international mining company working in Tanzania reported that his company did a lot of training of Tanzanian employees, which he maintained was typical of the mining industry everywhere. Even though engineering jobs in the mining industry were often well paid, he explained that the industry still lost senior people to government jobs and to other jobs in Dar es Salaam as they are seen as more prestigious. The Tanzanians trained by the company were also often poached by neighbouring countries which were expanding their resource-based industries.

### b) Tertiary education institutions

One interviewee based in South Africa but with extensive experience throughout the continent, argued that pockets of excellence in engineering education do exist. An interviewee from Zimbabwe also stated that engineering graduates in that country were of high quality (although this had changed with deteriorating conditions and current graduates did not match those produced before 2000).



However, the majority of interviewees expressed the view that the quality of tertiary engineering education was substandard (compared with the developed world) and was perceived to have deteriorated. The most commonly identified cause was the poor quality of teaching in tertiary education institutions (TEIs). The principal reason identified for this was that teachers were not well paid. It was therefore difficult to attract and retain high quality staff, and those who could be persuaded to teach were usually engaged in private practice as well to earn additional money, so they were not fully focused on their teaching duties. In addition, some interviewees expressed the view that teachers did not have enough experience in industry which meant that their knowledge did not sufficiently reflect current industrial practices.

Underfunding of TEIs was blamed for creating other difficulties, including sub-standard facilities and excessively large class sizes. It was highlighted that there was little funding for research and limited access to journals for disseminating research findings or accessing research done by others. These problems created a difficult learning environment, left students unmotivated and were a further critical deterrent to potential applicants for academic posts.

Finally, one Nigerian and the interviewee from Zambia maintained that the university syllabi were not updated with sufficient frequency. It was suggested that syllabi were updated approximately every 20 years, therefore the material being taught was out of date and the universities produced students that were not up to international standards.

c) Links with the private sector

Several interviewees noted that links between TEIs and industry were not sufficiently strong. The result was that TEIs did not understand the needs of industry and produced graduates that were not ready for the workplace. Concern was also repeatedly expressed regarding the difficulty in many countries for students to find workplace placements during their studies.

One interviewee from Nigeria believed that weak links between TEIs and industry were due in part to the high proportion of engineering projects that were now awarded to foreign firms that had no interest in creating links with national TEIs. Another Nigerian interviewee suggested that generating workplace experience for students was difficult because most firms in Nigeria were very small – employing just a handful of staff – so it was very difficult for them to take on a work experience student. One interviewee noted that most engineering lecturers had their own private practice, and expressed surprise that these lecturers did not appear to bring their private sector experience into the classroom.

A lack of workplace training as a part of structured professional development with proper mentoring emerged as a clear message from a number of interviews. Numerous explanatory factors were suggested for this, some of which have been covered above, such as the competitiveness of the global economy and the risk that well-trained engineers will emigrate, or move to another sector. Other factors mentioned included weak statutory bodies and an absence of legislation to state that professional engineers must be registered. These issues will be examined in the next section.

Links with the private sector might be stronger in the extractive industries (oil, gas and mining) than in the civil engineering sector. One interviewee managing mining activities

in Tanzania explained that his company provided practical work placements for students and offered scholarships, bursaries and loans to the best students. It also supported the local engineering universities with facilities and curriculum development.

d) Engineering institutions, registration and training

Several interviewees discussed the shortcomings of engineering institutions in their respective countries, as well as the legislation (or lack of) that required engineers to be registered and to engage in continuous professional development.

This is one area in which the interviews indicated a great deal of variation between countries. One interviewee from Zimbabwe, for example, considered that the registration process for engineers in that country was very similar to the UK process and functioned well. He also believed that the Zimbabwean Institution of Engineers (ZIE) played an important role in supporting the profession, although it was underfunded and under-resourced.

Unfortunately the picture elsewhere was rather different. It was stated that in several countries, there was no formal process of registration. A senior Nigerian engineer saw this as a major problem in his country as there were many unqualified people selling their services as engineers and he argued that this damaged the reputation of the engineering profession. This was also the case in Botswana, according to another interviewee, although he noted that legislation to formalise the process of registration would shortly be enacted.

In other countries, it was pointed out that while there was a formal process for registration, this in itself did not guarantee the quality of engineers. For example, an interviewee from Zambia explained that, in his country, there was a requirement for registration but no tests, examinations or predetermined entry standards, only an 'evaluation committee' which looked at experience and qualifications. A more structured process was currently under discussion.

The majority of interviewees stated that engineering institutions and bodies did exist but they were poorly resourced. The principal reason given was that members (be they individuals or firms) were not well off and therefore either did not join or could only pay very low membership fees. There was a call for professional institutions to be more proactive in following engineers through their training and for the recruitment of more forward-looking people to these institutions who would be prepared to change things.

e) Governments

A low level of investment in many African countries over several decades was identified by some interviewees as a key reason for low capacity in SSA. The South African interviewee explained that this had meant inconsistent demand for qualified engineers which had seriously limited the opportunities for African engineers to gain experience and skills.

Beyond the lack of investment, several interviewees argued that the absence of legally required registration, to ensure that those offering engineering services were suitably qualified, was a failure on the part of governments to legislate and to ensure that legislation is enforced appropriately. In the case of Kenya, it was argued that while

registration was required for engineers, the failure of the government regulators to enforce it resulted in many people working as engineers without being registered.

It was also suggested that policymakers needed to insist on more local participation in infrastructure projects and companies needed to be made to comply with the spirit of local content laws. Too often the foreign contractors claimed that they were unable to find locally qualified engineers and requested permission to bring engineers, or even artisans, from their own country. Governments seemed too willing to concede to these requests.

A number of interviewees expressed the view that policymakers in their countries did not recognise the importance of engineering and did not prioritise engineering capacity building to the extent required. As one interviewee put it:

*"Democracy and freedom are important, but without a concentration of energy on engineering and science, poverty will not disappear, illiteracy will not disappear, poor health will not disappear. All the solutions to all of these physical handicaps are rooted in engineering. And I don't think that the third world countries' leadership understands that."*

The need to get engineers into positions within government in African countries, so that governments would be better informed about the needs of the sector was highlighted several times. It was also stressed that engineers themselves needed to work to increase policymakers' understanding of engineering and its role in development.

A number of Nigerian interviewees complained that infrastructure ministries were not headed by engineers but by "political appointees" and that consequently awareness of the challenge of capacity building was low. By way of example it was suggested that the current interview survey to explore capacity building needs was the kind of initiative that the government should be engaged in. Concern was expressed that questions about engineering capacity were not being asked in Nigeria, and that the issue was not given sufficient profile.

#### **4. Perceptions of the impact of lack of capacity on development**

Most interviewees expressed the view that lack of capacity in the engineering sector had an impact on development. The impact mentioned by most interviewees (perhaps not surprising as most were civil engineers) was lack of national capacity to develop infrastructure. The resulting use of foreign engineers was seen as damaging to national identity as foreign firms overlooked national characteristics (for example, by creating buildings that didn't reflect the local culture and identity). Lack of capacity was also thought to result in poor maintenance of existing infrastructure as local engineers lacked the necessary skills.

One interviewee from Nigeria expressed the view that the construction of infrastructure costed more as a result of capacity gaps as foreign contractors had to be brought in:

*"In 50 years of Nigerian independence, we still do not have the capacity to build power plants. We do not have the capacity to build refineries. We do not have the capacity to do construction work at high level, because we haven't built capacity."*



*.. the result of that is that the cost of infrastructure is very high because you have to pay foreign companies and foreign contractors to do the work, therefore the money doesn't go far enough.*<sup>1</sup>

On the other hand, some other interviewees pointed out that Chinese contractors were now completing works at costs lower than would be possible for African contractors.

One Nigerian interviewee suggested that lack of engineering capacity had resulted in infrastructure gaps which discouraged investors and thus slowed economic growth. He used the example of the unreliable power supply in Nigeria (although it should be noted that engineering capacity is unlikely to be the only reason for unreliable power supply).

The interviewee from Zambia believed that lack of capacity to develop and manage projects had prevented Zambia from accessing donor funds. He gave the example of \$300 million of World Bank funding that was lost due to low capacity within government ministries to develop the project.

At a more general level, an interviewee who had worked with the World Bank for many years maintained that lack of capacity in engineering made it difficult to support the continent's current relatively high rates of economic growth (5-6%):

*"The impact [of lack of engineering capacity] in short is: the growth rate and the economic transformation that we all desire for these countries cannot happen as rapidly as one would like, or as one would have seen in India, or Thailand, or Malaysia, or say China"*<sup>2</sup>

Several interviewees identified the pace of global technological change as a major challenge, and feared that African engineers were being left behind. One interviewee expressed his frustration that:

*"We keep recycling old knowledge, as in.. going back to design principles that were being used in the 80s..."*<sup>3</sup>

Interviewees from both Nigeria and Zambia expressed particular concern over the shortage of high-end engineering skills. The result, they argued, was that manufactured products could not compete in international markets and Africa lost out on contracts for high-value added products and services.

## **5. Approaches to capacity building**

The above material demonstrates that the challenges in building capacity in the engineering sector in sub-Saharan Africa are many and, in some cases, daunting. However, the interviews also revealed that there is no shortage of ideas for approaches to building capacity, and there are a number of promising initiatives underway.

This section is divided into a number of themes. Section (a) discusses the need for more information on the state of the engineering sector in individual countries in order to form a sound basis for policy development. Section (b) covers the need for legislation

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<sup>1</sup> Bayo Adeola, Managing Director of Comprehensive Project Management Services Ltd, Nigeria and former President of the Association of Consulting Engineers Nigeria

<sup>2</sup> Dr. Anil Bhandari, Consultant with the World Bank

<sup>3</sup> Eng. Eneh Chindu, Project Lead and Senior Manager, Unecon Associates Ltd, Nigeria

mandating that engineers must become professionally registered, with strong statutory bodies to support that process.

The following two sections discuss the need for greater coordination and collaboration between (c) engineering institutions, academia, industry and policymakers and (d) countries on both a regional and inter-regional basis. Section (e) summarises interviewees' views on how to foster better exchange of knowledge and skills with foreign firms working in Africa.

The final two sections set out interviewees' arguments for a greater and more coherent effort on the part of donors and a greater role for the diaspora.

Throughout this section, the need for engineering institutions (as well as other bodies such as business associations) to develop their capacity is a cross-cutting theme. Many of the suggested approaches would need to be initiated by these institutions and all would require their involvement. At present, engineering institutions in most sub-Saharan African countries do not have the capacity to fulfil this role.

a) Better information on the state of the engineering sector

A number of interviewees expressed the need for improved information on the state of the engineering sector in their countries. Such information was required as a basis upon which to develop a policy for capacity building, and also to raise awareness of problems in the engineering sector amongst key stakeholders such as industry and government. The required information highlighted in the interviews included data on the demands from industry and the capacity of the engineering sector in each country (numbers, competencies etc.)

In addition, several interviewees expressed the view that more information was required on the state of infrastructure in their country, in order to understand the extent of the gaps in the delivery of basic services. It was suggested that Nigeria needed an equivalent of the UK Institution of Civil Engineers' 'State of the Nation' report that provided a picture of the condition of the nation's infrastructure each year.

b) Registration of professional engineers and capable statutory bodies to support the process

Registration was seen by many of the interviewees as a prerequisite to ensuring standards and thus preserving the reputation of the profession. It was also seen as a necessary step to building capacity in the sector. It was noted that government acts of this type were in the process of being enacted in Zambia and had recently been enacted in Botswana. The interviewee from Botswana explained that the Botswana Institute of Engineers (BIE) had managed to ensure that the Registration Act included the requirement that to apply for registration, an engineer would first have to be a member of the BIE. The interviewee believed that this would greatly strengthen the BIE as it would boost its membership thus making the institution more viable and hopefully more able to make a contribution to improving engineering capacity.

An interviewee with many years' experience working with the World Bank was involved in a project to revise the Engineers' Registration Act in Kenya at the time of the interview. The Engineers' Registration Board would be charged with overseeing and

facilitating both continuing professional development (CPD) as well as training of new graduates. A new body – the National Construction Authority – would be set up to oversee the process, in addition to training contractors. These developments were seen as key steps towards ensuring better training of engineers. They should also enhance the involvement of private companies in the development of the profession, as firms would have an incentive to provide training for their employees so that they could be registered. The interviewee explained that having registered engineers, who would be licenced to oversee work onsite or sign off designs, would enable the company to expand.

c) Collaboration between engineering institutions, industry, academia and government

Several interviewees were of the view that it was important to develop a structured system of work placements for engineering students. Development of industrial attachments, staff training and bringing in industrial mentors were seen as key to progress. It was recognised that this would need funding from public budgets as well as through partnerships between industry and academia.

The interviewee from the mining sector suggested that the key to improving engineering capacity lay in government, private sector and professional institutions working in partnership and taking a long-term view. Several of the interviewees discussed the need for better connections among all industry stakeholders including academia. This would facilitate the sharing of information on capacity building needs as well as the sharing of ideas on approaches to building capacity.

Engineering institutions and bodies are seen to play a key role in facilitating improved collaboration and coordination. One interviewee stressed that the best way to improve collaboration between these bodies was through their involvement in actual projects, in order to ensure that efforts to establish partnerships did not result in a 'talking shop'.

d) Partnerships with other countries: regional and inter-regional

Exchange and learning between countries were seen as important support mechanisms for each of the four engineering sector stakeholders discussed above. Some interviewees argued for more partnerships with industry, academia and institutions from developed countries. Partnerships between universities in the developed and developing worlds were considered particularly important.

Others argued that south-south partnerships could now be just as important as north-south partnerships. Some Asian countries were noted as having excellent technical universities and possibly more cost-effective technologies than northern hemisphere countries.

Collaboration with other African countries going through similar processes was also considered important. South-south capacity building within Africa was an avenue that had been overlooked in past decades. Regional fora were considered of great importance, particularly for developing excellent training institutes and sharing resources. African engineers, it was argued, can learn a lot from each other.

e) Enhanced skill and knowledge transfer with foreign firms working in Africa

Given the high number of foreign firms currently working in SSA, and particularly Chinese firms, several interviewees stressed the importance of improving skill and knowledge transfer between these firms and local engineers. Several approaches were proposed. The first was that governments make greater efforts to ensure that local engineers were involved in projects awarded to foreign firms. At the very least, it was argued, this should be possible in the case of donor-funded projects.

The second proposal was that engineering institutions and bodies and/or donors make greater efforts to persuade firms that there is a business case for training locals rather than importing foreign staff. Such a case could be made on the basis of the lower cost of employing locals (although this might not be true for Chinese companies). It was suggested that in this context it was important to see the involvement of Chinese contractors as a potential opportunity rather than a threat. Interviewees proposed that African countries should be engaging with Chinese businesses and working with them to find better solutions.

It was also suggested that engineering institutions should get more involved in monitoring the extent to which skills and knowledge were being transferred from foreign firms, and should then lobby accordingly.

f) Greater and more coherent effort on the part of donors

Many of the interviewees believed that insufficient efforts were typically made by donors to proactively build an engineering capacity building element into their programmes. In particular, donor projects failed to employ national staff, using their own engineers and contractors instead. It was suggested that it would be good for 'institutional memory' if more local people were involved.

The second shortcoming, expressed by international staff working with donors, was that donor capacity building programmes tended to be self-contained projects run by consultants from the developed world and that this model did not build capacity in a sustainable manner. These interviewees believed that capacity building programmes would be far more sustainable if they worked through African institutions and over a longer period of time.

An interviewee with many years' experience working with donors expressed the view that donors should implement more programmes for which capacity building was a central focus, rather than just an addendum to an infrastructure project. One example he gave of where this was done very well was AFCAP [Africa Community Access Programme] which he said had: "bent over backwards to involve as many local people as possible at all levels". He explained that AFCAP's particular focus was rural accessibility and promoting capacity development by involvement of local people.

One interviewee suggested that donors ought to, "use the local private sector as an engine of development." The importance of donors engaging with the local private sector was raised by other interviewees and this view closely relates to the call, mentioned above, for donors to employ local engineers and to engage local contractors.

g) Greater role for the diaspora

Several interviewees believed that the diaspora could play a greater role in building capacity in the engineering sector in SSA. The proposed principal route through which this could be achieved was by engineers working overseas returning to their countries of origin to set up businesses, bringing the benefits of the knowledge and networks they have gained during their period abroad. The principal barrier to enhanced diaspora involvement was seen by one interviewee to be the government's lack of proactive engagement. He explained that governments needed to create an environment where returnees could feel comfortable and could have confidence that they would be able to contribute to the development of the country. Donors could also support the greater involvement of the diaspora, perhaps by helping to finance the capacity building element of investments.

## **6. Conclusions**

Consensus emerged among the interviewees on a range of issues and a few points were raised that have had little attention in the existing literature. All interviewees believed there was a notable lack of engineering capacity in SSA, both in terms of numbers of qualified engineers, and insufficient skills and experience among existing engineers. The most commonly stated causes of these capacity deficiencies were: brain drain due to SSA engineers moving to other countries and sectors; substandard quality of education when compared with developed countries; insufficient support structures for professional engineers in the form of registration and CPD, both of which were partly considered to be due to low capacity in professional engineering bodies (ineffective or nonexistent registration processes were also blamed for allowing unqualified people to practice as 'engineers', thus reducing the overall quality of engineering projects); a lack of public investment in engineering sectors and inadequacies in public policy making.

Major infrastructure gaps were often cited as due (in part) to this lack of engineering capacity and, as such, low engineering capacity was considered an obstacle to meeting development goals. Low capacity was also believed to result in widespread use of foreign contractors for the provision of infrastructure which not only exacerbated the problem of a lack of experience among local engineers but also damaged national identity through the creation of structures that did not reflect local cultures and traditions. Finally, it was argued that low capacity prevented SSA from keeping up with the global pace of technological change, thus limiting the potential for growth in the region.

Several recommendations were made regarding strategies for improving engineering capacity. The most popular of these among interviewees were: national data collection on capacity needs in order to inform suitable public policy and donor strategies; efforts by donors to put capacity building at the focus of their activities rather than adding it as a 'bolt-on' to infrastructure projects; establishment of enforced legal structures for the professional registration of engineers, and capacity building within professional bodies in order to enable them to support registration processes; better knowledge transfer from foreign firms to local engineers; the development of knowledge-sharing partnerships between academia and industry and



between institutions internationally; a greater focus of donor activity on engineering capacity building; and better engagement of engineering diaspora communities.

These interviews largely support the existing literature on the subject, while offering a richer context and a broader set of data for the region.