



Needs and Numbers Engineering Study in the SADC Region

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Introduction

There has never been greater pressure on nations to improve economic growth to address the burgeoning challenges of poverty, food security and unemployment. Linked to these is the need to improve health care and education. Engineers can play a significant role in changing the fortunes of countries, provided that their skills are recognised and an environment is created where they are utilised to the full, to deliver infrastructure, and use innovative approaches to improve agricultural production and exports, and increase manufacturing and mining output amongst others. Nine of the 17 Sustainable Development Goals (SDGs) are reliant on engineering skills and several others require engineering facilities to be in place.

Based on the publication of 'Numbers and Needs in Civil Engineering'¹ published in 2005, a study has been commissioned to determine the engineering population in the SADC region with a view to understanding the gaps and how engineering skills can be strengthened to support national and regional growth.

This paper describes several skills investigations and their conclusions and calls on stakeholders in the region to work together to amass data, challenges and recommendations, to allow structured approaches to engineering skills development to be put in place. Recommendations must be published, funded, and implemented as widely as possible.



Engineering skills studies and their findings

Tanzania: 2004 – Capacity Building by the Engineers Registration Board

At the time of independence in 1961 Tanzania boasted only two indigenous engineers. Recognising the need to develop a pool of local engineers, the government took deliberate steps to train engineers and by 1997, there were over 4000 engineers in Tanzania. However, few were registered with the Engineers Registration Board (ERB) as registration was voluntary. After extensive deliberations and negotiations, the Engineers Registration Act of 1997 was enacted which made registration compulsory. Progress with registration was slow which led the ERB to develop a strategy² to achieve self-sufficiency in engineering capacity which has yielded good results. The main thrusts were to implement:

- Structured Engineer Apprenticeship Programmes (SEAP) for graduates
- Continuing Professional Development (CPD) to ensure that engineers keep up to date and remain creative and innovative when problem solving
- Capacity Building to develop the capacity of consulting engineers

South Africa: 2005 – Numbers and Needs in Civil Engineering

In the early 2000s, it became evident that the number of engineering practitioners had dropped significantly due to the slow economy in earlier years and significant levels of emigration. Considering the skills that would be required to deliver the infrastructure required to host the 2010 Soccer World Cup (SWC), including stadia, hotels, Gautrain, and significant road upgrades, at the same time as building new power stations among others, the Numbers and Needs study into civil engineering capacity was carried out. It was estimated that there were just over 15 000 civil engineering practitioners, but to deliver the planned



infrastructure some 21 000 were required. Many initiatives were put in place, including expanding university capacity; accessing funding for intern and candidate development, and encouraging those who had either retired or left the industry to return. By 2009 capacity was significantly increased, and developments for the SWC were completed on time.

Zimbabwe: 2009 – Technical Skills in the Mining Sector in Zimbabwe

In 2007, it was estimated that more than half the industry's skilled personnel had emigrated from Zimbabwe and that in early 2008 there were 1116 vacancies for professional and technical staff. Given the need to train more technical personnel for mining, the limitation of the University of Zimbabwe to train only 124 mining related students per annum presented a significant challenge. Furthermore, staffing was at an all-time low, with 66% vacancies in the engineering department. A report prepared by Prof Viewing made many suggestions with respect to rebuilding capacity which contributed to stabilising the situation. These included setting up additional shorter qualifications, encouraging the development of cadet programmes to encourage graduates to enter the Zimbabwean mining sector and recommending more competitive salaries and the use of the 'Fast Track' programme to encourage expatriates to fill academic posts, amongst others.

South Africa: 2014 – Skills for and through SIPs

When President Jacob Zuma announced the National Infrastructure Plan in his State of the Nation Address in 2012, he stated that *'the massive investment in infrastructure must leave more than just power stations, rail lines, dams and roads. It must industrialise the country, generate skills and boost much needed job creation.'*



To determine the skills required to deliver the major projects, a detailed investigation into the occupations required, and shortages was carried out. Many engineering professions, trades and operators were found to be in short supply. The need to reinstate apprenticeship and artisan training and develop graduates towards the competence required for professional registration were recognised. The latter phase has been defined and recognised as candidacy, and today thousands of engineering and built environment graduates are being developed on funded candidacy phase programmes in both public and private sectors.

Others

The above are a selection of major research initiatives which illustrate the benefits of carrying out research and will guide the SADC engineering study.

Engineering skills

The engineering skills pipeline is shown in Figure 1³. Interventions at various stages of the pipeline were discussed above. Many bodies and institutions need to contribute to the development of engineering skills including schools, higher education institutions, employers, registering bodies, voluntary associations, and the public sector. Supply and demand must also be understood and addressed. The supply is represented by the current workforce, but demand is driven by current needs, expected growth, and the need to replace those exiting the workforce. To determine the current demand, work studies will be necessary, while to determine growth requirements, details of future projects and developments must be studied. To determine replacement demand, mobility, retirement, and morbidity must be understood.

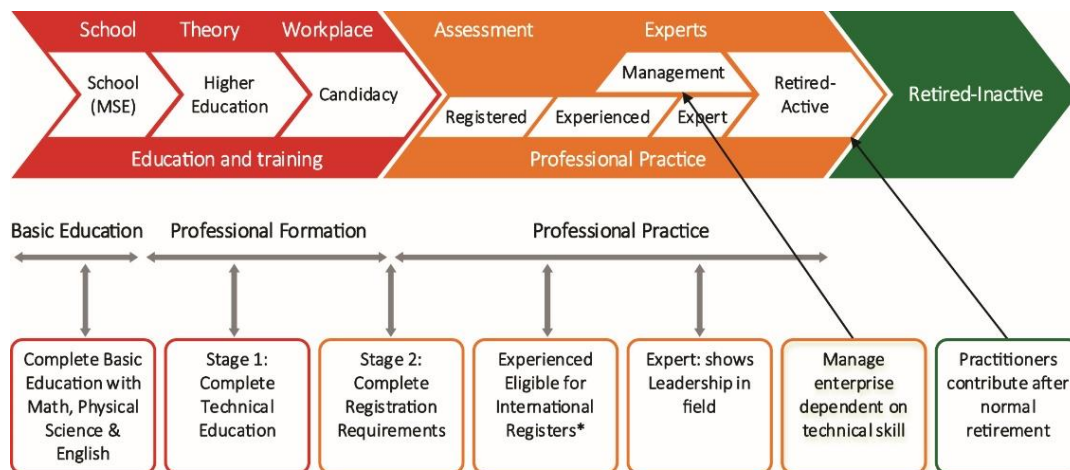


Figure 1: The engineering skills pipeline

SADC Needs and Numbers Study – the contribution of engineering to GDP

The development of engineering infrastructure supports growth, which in turn supports job creation, addressing poverty and associated maladies. Considering gross domestic product, the sectors against which percentages are reflected are usually agriculture, forestry and fisheries; construction; gas, energy, water; manufacturing; mining and quarrying; transport and communication; financial and business services; government; social services; and wholesale, retail, accommodation. The first six rely on engineering skills. In figure 2, it can be seen that some engineering sectors make a substantial economic contribution. However, on investigation, many only represent primary industry. For instance, in many countries, there is little mineral beneficiation, most mining products are simply exported. Smelting, producing industrial products and jewellery as examples, would go a long way to assist with job creation. In other countries, agricultural production is limited and it is recognised that irrigation systems and refrigeration are needed amongst others, to get products to markets. In these instances, the role of the engineer becomes important.

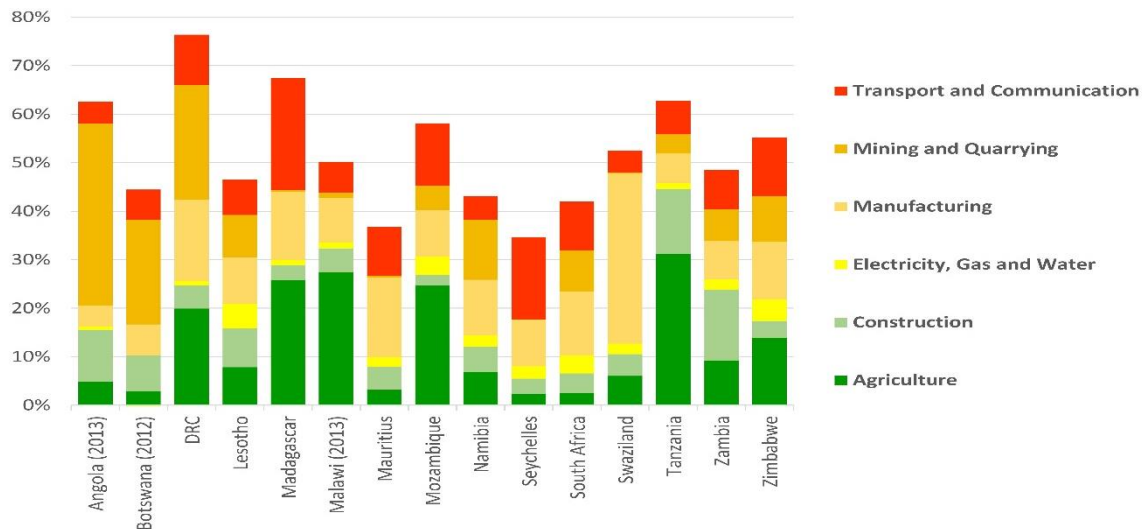


Figure 2: The contribution of engineering sectors to the GDP per country in 2014 (unless noted)

Engineers have a significant role to play in leading the transformation of each sector in which engineering plays a major role. The study seeks to understand the roles engineers can play and how to develop the capacity required.

Focus areas

The focus areas suggested in many SADC studies are mining, construction, agriculture, and manufacturing, with an emphasis on pharmaceutical production. For this study, all six engineering sectors will be considered. Information per sector, plus indications on the bottlenecks, skills required, and possible interventions to address the challenges are being sought.

Skills supply and demand

To determine gaps and possible interventions data on the following is required:

- **Stock – determine the size of the existing workforce:** Country surveys and input from bodies with knowledge of each discipline or focus area will be sought including labour force surveys; professional body membership statistics and registration board or council registration statistics.



- **Losses – determine staff turnover and losses:** Losses due to emigration, those leaving engineering, retirements and mortality must be quantified.
- **Supply – determine inflows:** To compensate for losses, new inflows will be required coming from higher education, immigration, international project teams for specific projects, and those returning locals who trained overseas.
- **Demand – determine expansion and replacement demand:** The demand includes staff required to address current needs, the additional capacity to deliver national infrastructure plans, and areas identified to support economic growth, such as boosting the manufacturing or agriculture, and capacity to fill existing or latent vacancies, plus those arising from losses to the industry.

Stakeholders

From the above, it is evident that substantial sets of data are required and we are calling on those present to contribute or link us to stakeholders who can supply the data and input required. These include, but are not limited to:

- Government infrastructure departments and those supporting science, engineering, technology, innovation, and the likes
- Ministries responsible for education and higher education institutions
- Registering councils and bodies, learned societies to which individuals belong and voluntary associations to which organisations belong
- Service providers working in SADC who have created local networks

Links to these stakeholders per country are required to gain access to any data they have, as well as insights they may be able to share.

Contribute to the Needs and Numbers Study

We call on everyone to participate in the study in some way.

- **Studies, lessons learned, policies** – please share studies, research, lessons learned and policies associated with engineering skills development



and areas in which increased engineering capacity has improved the, efficiency and/or return on investment in a sector, or even small niche area

- **Data** – please share data on engineering skills – whether source data from membership databases (excluding personal details), or annual statistics etc.
- **Questionnaires** – a series of qualitative questionnaires have been prepared per sector to allow us to gain an understanding of trends, challenges and solutions. Please participate in our various surveys.
- **Contact details of experts** – if you do not have access to, or are not au fait with all the data, trends and possible solutions, but know of experts in any of the above fields, please let us have their contact details.
- **Register on the information sharing portal** – if you have any of the above data, or have developed expertise in one of the areas discussed and would like to participate in the study, register on the research portal. To register, log on to www.needsandnumbers.co.za
- **Our contacts** – if you are not able to collaborate on the portal, but can share data or documents, please email Marthelene Buckle on saice@ally.co.za or call her on +27-11-476 4100.
- **Visit our stand** – to chat to members of the research team, register on the website or discuss or collect all questionnaires and guidelines to participate in the study please visit Stand 13.

Conclusions

Let us work together as engineers, apply the problem-solving skills for which we are recognised, and collectively understand the engineering opportunities to grow our economies and engineering skills base.

¹ Lawless, A. 2005. Number and Needs: Addressing Imbalances in the Civil Engineering Profession. Midrand, SAICE

² Mwamila, BLM, Mkamba, AO & Mushi, E. 2004. Capacity Building Initiatives by the Engineers Registration Board. Dar-es-Salaam: Engineers Registration Board

³ Acknowledgement for this diagram to the Engineering Council of South Africa (ECSA)