Ensuring excellence in engineering, the built environment and information technology

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At the beginning of the century, the Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria set itself the goal of significantly increasing its contribution to the positioning of South Africa as a competitive research-intensive country and leader in Africa.

The plan was to build on the existing foundation of high-quality education at undergraduate and postgraduate levels, as well as its excellence in research, by increasing the student numbers, and research intensity and outputs of the Faculty. This was done in close collaboration and with the support of the University, government and industry to expand the Faculty's facilities and human resources.

As its name indicates, the Faculty serves the engineering, built environment and information technology professions with professional programmes in the major disciplines in these fields, with further specialisation at senior undergraduate and postgraduate levels. The focus on engineering and technology management was further strengthened in 2007 by placing these activities in a separate Graduate School of Technology Management.

Advisory boards were formed at both faculty and departmental levels to foster closer cooperation and alignment with industry. High-level participation in these boards has contributed significantly to the successful alignment of the Faculty with government and industry initiatives and has succeeded in attracting support and funding for new facilities and research chairs. It has also ensured that the programmes offered in the Faculty, together with the research conducted, are relevant to the market, while the experience gained by graduates can be applied in practice and meets industry requirements.

Growth in student numbers

The School of Engineering is one of the largest of its kind in South Africa, and produces by far the largest number of graduates in the country. It comprises seven departments: Chemical

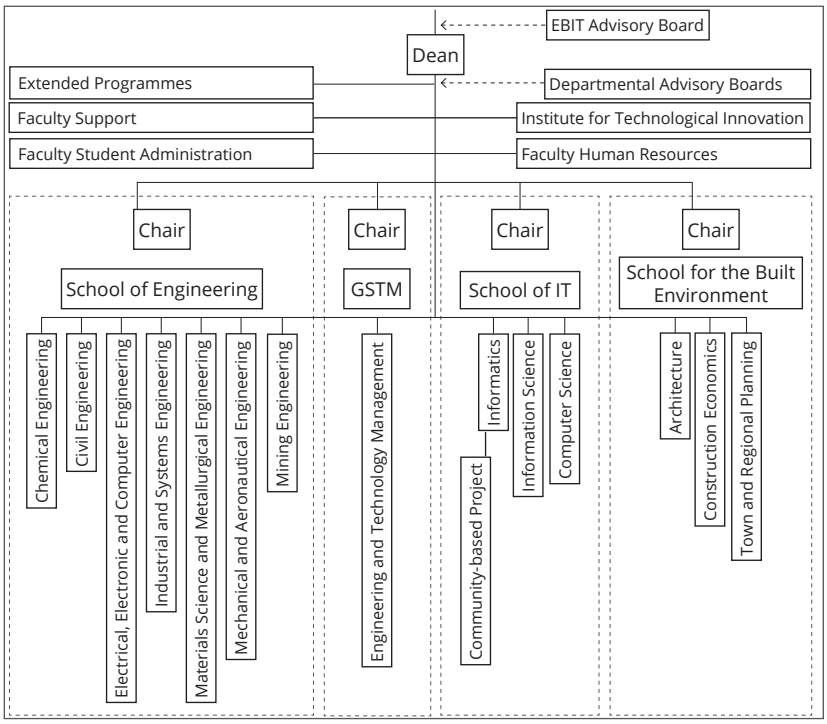

Figure 1: Structure of the Faculty of Engineering, Built Environment and Information Technology.

Engineering, Civil Engineering, Electrical, Electronic and Computer Engineering, Industrial and Systems Engineering, Materials Science and Metallurgical Engineering, Mechanical and Aeronautical Engineering, and Mining Engineering.

Student numbers in the programmes in engineering and engineering management have almost tripled since the turn of the century, from under 2 000 to almost 6 000. The growth can largely be attributed to the increased participation of black students. To accommodate this growth, significant support was obtained from government and the University Council to considerably expand the School of Engineering through the construction of additional lecture halls, as well as research laboratories.

The School for the Built Environment is also one of the largest of its kind in the country and covers the entire spectrum of programmes in the built environment. It comprises the departments of Architecture, Construction Economics, and Town and Regional Planning. Its programmes have all been redesigned to align them with international norms, and include professional qualifications in Architecture, Interior Architecture and Landscape Architecture. All the programmes in this School are internationally accredited, display a commitment to innovation, and strive to promote the equitable and sustainable development of a prospering, rapidly urbanising South African society.

The School of Information Technology is the first of its kind in South Africa and students have the advantage of an integrated approach to information technology (IT). It comprises the departments of Computer Science, Informatics and Information Science. Close links exist with the Department of Electrical, Electronic and Computer Engineering in the School of Engineering. The integration of these three academic departments into one school has brought considerable advantages for the academic programmes that are offered. It has an excellent and modern infrastructure to support teaching, sophisticated undergraduate computer laboratories and specialised research facilities.

The Graduate School of Technology Management (GSTM) presents postgraduate programmes in the Department of Engineering and Technology Management. It also offers internationally recognised management development programmes that address different needs in the fields of technology management, engineering management and project management. The aim of its programmes is to provide graduates with skills and knowledge on the management of engineering processes, systems and services. A strong focus on research ensures relevance to the market in terms of increased competitiveness, optimising product life cycles and technology transfer, and positioning technological context.

Teaching and learning

The language of instruction for the programmes offered is English, with most courses also offered in Afrikaans at undergraduate level. In some programmes, language

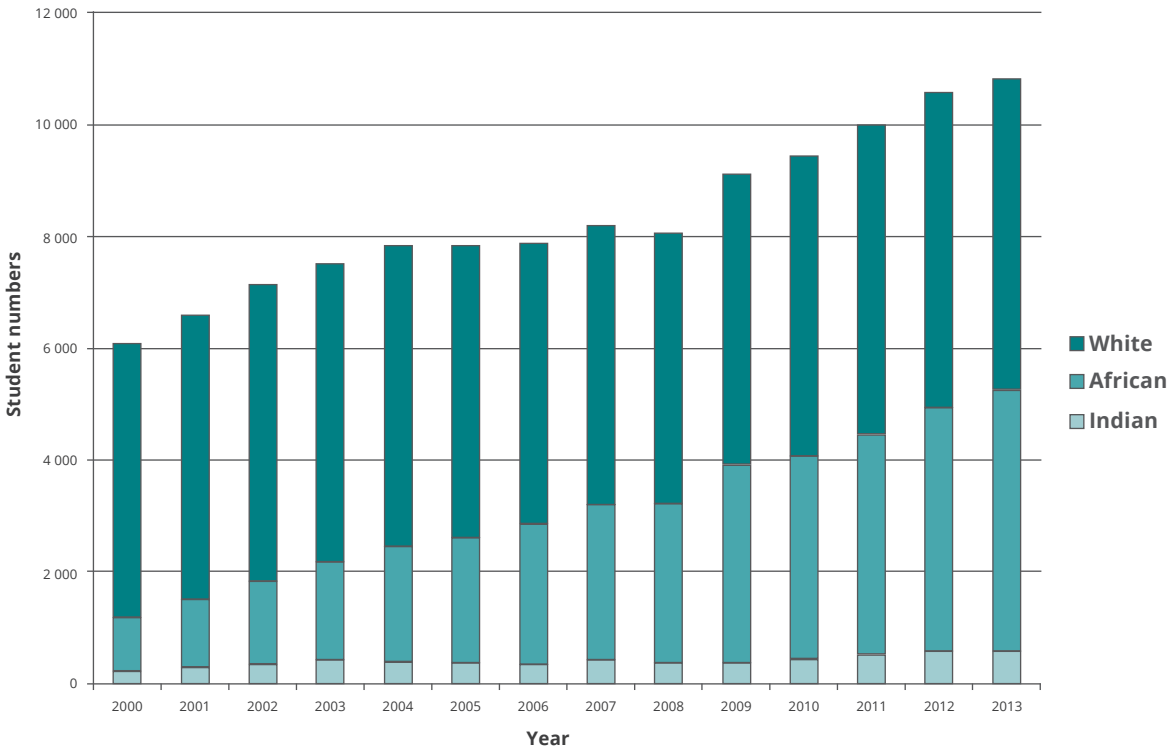

Figure 2: Composition of the student enrolment in the programmes offered in the Faculty.

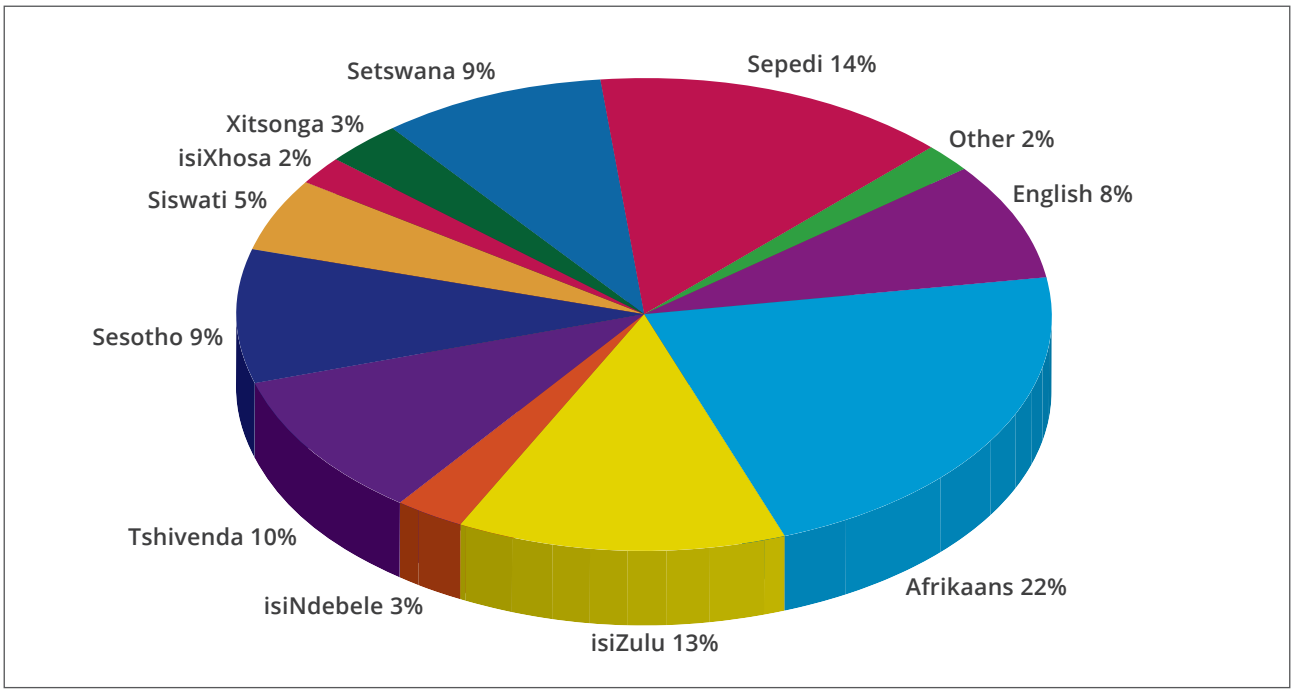

Figure 3: Home languages of the students enrolled for Mining Engineering in 2013.

proficiency poses a significant challenge, such as in Mining Engineering, where only 8% of the students in the 2013 cohort had English as their first language (see Figure 3). Significant success has been achieved to improve the communication skills of these students with the presentation of additional language and communication programmes. The programmes offered in the Faculty are reviewed on a regular basis to stay current and to optimise its offerings. A major review of the engineering programmes was undertaken to improve teaching and learning, promote alignment with international best practice, reduce teaching overload, increase commonality and reduce duplication, as well as to create space for more independent study and creative activities.

Access to and success in the programmes of the Faculty are enhanced by the Engineering Augmented Degree Programme (ENGAGE), in which the study period is extended by one year, with extensive support and additional modules required in the earlier years.

The increase in graduation numbers over time bears testimony to the success of these measures to ensure study success.

Community engagement

The ability of students in the Faculty to operate in complex and multicultural environments is strengthened by their participation in the compulsory undergraduate Community-based Project Module (JCP). The establishment of this module in February 2005 was a milestone for the Faculty.

Students are trained in community engagement protocols and have to conceive and execute a community-based project that involves working at least 40 hours in a community. They then reflect on their experiences through web-based systems and present their project to their peers and the programme leader.

Projects are aimed at achieving a beneficial impact on a chosen section of society by engaging with a community that is different from learners' own social backgrounds.

In the process, they develop an awareness of personal, social and cultural values, an attitude to be of service and a deep understanding of social issues, while developing important multidisciplinary life skills, such as communication, interpersonal and leadership skills.

Expansion of facilities

With the construction of the Engineering 3 Building in 2010, the facilities available to the Faculty have been expanded significantly and have been modernised to accommodate the growing student numbers and research requirements. This building has 2 300 lecture seats in a variety of configurations, undergraduate and research laboratories, and offices arranged to facilitate the functioning of research groups, as well as parking for close to a thousand cars.

Significant support has been obtained from government to expand the facilities of the School of Engineering.

The laboratories for Chemical Engineering are in the process of being expanded and modernised, and the facilities available to Mining Engineering have been expanded through the industry-funded Kumba Virtual Reality Mine Design Centre, which will create additional space for other activities of Mining Engineering, and Materials Science and Metallurgical Engineering.

The development of the Mining Industry Study Centre in 2013 further contributed to the success of the University's engineering students by providing study and groupwork facilities for close to 800 students in close proximity to the other facilities of the School of Engineering.

The expansion of the facilities in the Faculty was made possible by substantial support from and collaboration between government, industry and the University.

Research

Research and postgraduate studies are regarded as core activities of the Faculty, and steady progress has been made with the improvement of the qualifications of its teaching and research staff, as well as increasing the quantum and quality of its research outputs. Significant growth has been achieved with developing research activities in each department with the establishment of several new research centres and research chairs.

The Faculty currently has the following research centres:

- Institute for Applied Materials
- SANEDI Hub in Energy Efficiency and Demand-side Management
- Centre for New Energy Systems (CNES)
- Centre for Electromagnetism
- Carl and Emily Fuchs Institute for Microelectronics (CEFIM)
- Centre for Telecommunications Engineering for the Information Society (CeTEIS)
- Eskom Power Plant Engineering Institute (EPPEI)
- Specialist Centre in Plant Asset Management
- SAIW Centre for Welding Engineering
- Kumba Virtual Reality Mine Design Centre
- African Centre of Excellence for Information Ethics
- Institute for Technological Innovation
- Industrial Metals and Minerals Research Institute (IMRI)

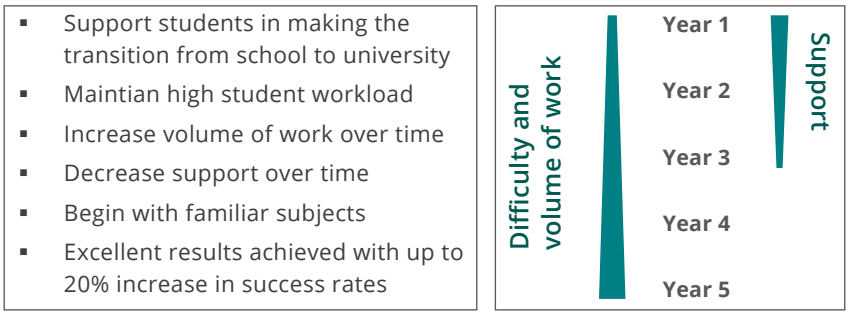

Figure 4: Structure of the ENGAGE degree programme.

The research chairs in the Faculty are as follows:

- SARChI Chair in Carbon Technology and Materials
- SARChI Chair in Fluoro-material Science and Process Integration
- SARChI Chair in Advanced Sensor Networks
- SARChI Chair in Artificial Intelligence
- Sedibeng Water Chair in Water Utilisation Engineering
- Transnet Chair in Railway Engineering
- Rand Water Chair in Civil Engineering
- Sentech Chair in Broadband Wireless Multimedia Communication
- Exxaro Chair in Energy Efficiency
- Electronic Defence and Radar
- CBI Low Voltage Chair in Power Electronics
- Chair in Maintenance Engineering
- Rand Water Chair in Mechanical Engineering
- Anglo American Chair in Pyrometallurgy
- Glencore Chair in Modelling of Pyrometallurgical Processes
- Tenova Chair in Minerals Processing
- Sasol Chair in Safety and Health
- Harmony Chair in Rock Engineering

Research output in the form of articles published in accredited journals, research reports and conference proceedings contribute to the University's ranking as a top research university. The Faculty's publication output has increased significantly over time, although some short-term decreases in output have occurred, resulting from increased emphasis on the quality rather than the number of outputs.

Significant progress has been made with the number of papers listed on the Thompson Reuters Web of Science, the number of citations and the citations per paper. The discipline of engineering at the University of Pretoria has maintained its position as the highest ranked in South Africa according to the Web of Science's worldwide rankings of the top 1% of engineering schools.

Considering the achievements of the Faculty against the goals set, good progress has been made and the contribution of the Faculty to the development of high-end human resources and research is on a high level.

However, it is also clear that, although a sound foundation for further development has been laid, much remains to be done, especially in terms of the pace of growth in research outputs, to significantly improve the Faculty's international standing.

The significant progress the Faculty has made in the fields of teaching, research and community engagement over the past 13 years provides a steady platform for sustained growth in the future.


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