



# Enhancing sustainability of minerals engineering programmes through the development of a Minerals Resource Centre

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## Synopsis

Depressed mineral commodity prices have a significant impact on the minerals industry, particularly from a sustainability perspective. In this regard, tertiary institutions across the world offering minerals education face enormous sustainability challenges. This problem is not limited to the developing world. The Department of Mining and Process Engineering (DMPE) at the Namibia University of Science and Technology (NUST) was established in 2009 with the objective of developing a critical human resource base for Namibia's mining industry. Despite the current challenges, the DMPE has the potential to make a significant contribution to the future of Namibia and the country's Vision 2030 skills imperatives. This paper presents the DMPE's strategy to ensure sustainability through mapping out a trajectory to provide quality minerals engineering programmes and strengthen capacity for the local industry through consultancy, research, and development. In the short to medium term, the DMPE aims to enhance its research capacity through the development of postgraduate programmes and the establishment of a national centre of excellence – the Namibia Resource Engineering Centre (NREC). The NREC's envisaged mission is to be an internationally recognized centre of excellence for research, consultancy, innovation, and technology transfer in resource engineering. The NREC will become a key enabler of national development through partnerships with the resource industry, government organizations, and communities. The sustainability of institutions offering minerals engineering programmes depends on their ability to deliver value to local industry.

## Keywords

sustainability, mining education, research and development, centre of excellence.

## Introduction

Depressed mineral commodity prices have a significant impact on the minerals industry, particularly from a sustainability perspective. In this regard, tertiary institutions offering minerals education across the world face enormous sustainability challenges (Phillips, 1999; Galvin and McCarthy, 2001). This is a global problem that is not limited to the developing world.

Mining education, like the mining industry, is typified by 'boom and bust' cycles. The deep 'bust cycle' that spanned the 1990s through 2011 catalysed renewed efforts to eliminate, consolidate, restructure, rename, reinvent, or otherwise change mining education to make it (for some) more economically or socially acceptable (Isaacs, 2011).

Mining education programmes globally have traditionally seen recruitment and survival at risk during industry down-cycles. For example, at the turn of 2000 many North American, as well as Australian, minerals education programmes were close to extinction (Scoble, 2003). It is unrealistic to believe that the minerals education sector can be relevant and sustainable while remaining in isolation from these dramatic developments.

The Department of Mining and Process Engineering (DMPE) at the Namibia University of Science and Technology (NUST) was established in 2009 with the objective of developing a critical human resource base for Namibia's mining industry. In spite of the current challenges, the DMPE has the potential to make a significant contribution to the future of Namibia and the country's Vision 2030 skills imperatives. This paper presents the DMPE's strategy to ensure sustainability through mapping out a trajectory to provide quality minerals engineering programmes and strengthen the capacity of the local industry through consultancy, research, and development.

## Background

Namibia is endowed with mineral resources and talented people. It is a vibrant part of Africa, with a stable political system and a burgeoning middle class. Namibia produces uranium oxide, Special High Grade zinc, and acid-grade fluorspar, as well as gold bullion, blister copper, lead concentrate, salt, and

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dimension stone. Rio Tinto and Vedanta produce and export uranium oxide and Special High Grade zinc, respectively. Moreover, Namibia is a primary source of gem-quality diamonds, mined both on- and offshore. De Beers works with the government of the Republic of Namibia through Namdeb Holdings in a 50:50 joint venture, producing some of the world's finest gem diamonds. Namibia's diamond output comes increasingly from the marine environment, reflecting the technical expertise of Debmarine Namibia. Value addition is boosted by eleven cutting and polishing factories, supplied with rough diamonds from the Namibia Diamond Trading Company, worth approximately US\$300 million annually (Ralston *et al.*, 2015).

For any country to develop technologically and economically there must be strong links between its industry, government, and academic institutions. All courses and programmes offered by such institutions derive their relevance from the needs of the nations they serve, and hence should promote development of existing and future industries (Tesh *et al.*, 2014). The direction of research at the DMPE was defined based on a thorough mapping of the Namibian minerals industry. This has the advantage of improving the synergy between the DMPE and the companies in the Namibian mineral industry. There is close collaboration with the Ministry of Mines and Energy, Chamber of Mines, Ministry of Industry and Trade, and the broader Namibian mining industry through the DMPE's Advisory Board. Furthermore, the Department has active memoranda of understanding (MOUs) with Namdeb, Swakop Uranium, Areva, and Gecko Namibia.

Nowadays, engineers and scientists required to lead the minerals industry into a competitive position have to emerge from innovative educational environments and from institutions that are forming global partnerships and understand the need to collaborate and share resources, irrespective of their location (Tesh *et al.*, 2014). This vision of meeting the industry's needs for technically competent graduates requires a major restructuring of the system. A close collaboration with stakeholders is essential if minerals tertiary education is to be sustainable in Namibia in the long term. Through stakeholder engagement, society gains a wide range of benefits. Interaction with universities leads to enhanced human and social capital development, accelerated economic growth, improved professional and intellectual infrastructure in communities, progress towards sustainability, and research outcomes that can benefit the social, economic, environmental, and cultural dimensions of society (Winter, Wiseman, and Muirhead, 2006). Full stakeholder engagement would imply that the university can identify relevant research topics and develop courses that employers need and students want.

### NUST Department of Mining and Process Engineering

The Department of Mining and Process Engineering has been in existence for nearly ten years. It has grown into a vibrant and proactive unit within the Faculty of Engineering. Founded in 2009 following a needs analysis, and through the efforts of two expatriate professors, it initially offered one degree course – the Bachelor of Engineering in Mining – with

two specializations, namely Mining Production and Mineral Processing. The Department experienced operational setbacks when the two founding members were reassigned to higher responsibilities in their countries of origin and were subsequently available to the Department only for limited periods. It was indeed a challenging time. The period 2011–2012 was characterized by limited research output as well as very restricted laboratory space and infrastructure. Unsurprisingly, staff and student morale was low. Industry engagement was limited and the Department faced the possibility of closure. The mining companies traditionally preferred older-established South African and overseas universities to the younger Namibian universities for their research needs. This was understandable, since minerals engineering education institutions in Namibia were still in their infancy and had to prove their capabilities before they could be accepted like longer-established institutions.

There were several threats that weighed on the DMPE and which had the potential to impact on its success. One of these threats was the prevailing global economic crisis, coupled with dwindling government financial support. This trend has also been observed in other universities in Africa and the western world, and has become a major constraint in attaining sustainability of education in general. Dwindling state funding has the biggest impact on new departments at universities that are trying to take their first steps towards building sustainable academic programmes regarding both teaching and research (Tjivikua, 2012). There was a need to tackle this threat before it eroded the benefits of offering minerals education programmes. Fortunately, there was a lot of experience available from the northern hemisphere and Australia, where measures have been taken in order to guarantee the sustainability of the minerals education programmes.

### The Resource Engineering Centre

The wealth to be gained from Namibia's natural resources will play a key role in the country's future development. The nation can leverage its natural advantages by embracing the science, engineering, and digital revolution; adapting and developing unique technologies and capabilities. Sharing a common time zone with many of its trade partners, Namibia is poised to make unique contributions to the 21st century. These resources are being developed with consideration to the overarching Harambee Prosperity Plan (HPP) and National Development Plans (NDPs), in step with Constitution Articles 95 and 100. Given the importance of natural resources to the nation, it is critical that the university establishes the Namibian Resource Engineering Centre in order to maintain, and increase, the international competitiveness and long-term sustainability of Namibia's resources, as shown in Figure 1.

### Functions of the Centre

The vision of the Namibia Resource Engineering Centre is to become the premier centre in Southern Africa for resource engineering, with the mission of becoming an internationally recognized centre of excellence for research, innovation, technology transfer, and consultancy in resource engineering, as shown in Figure 2. Through partnerships with the

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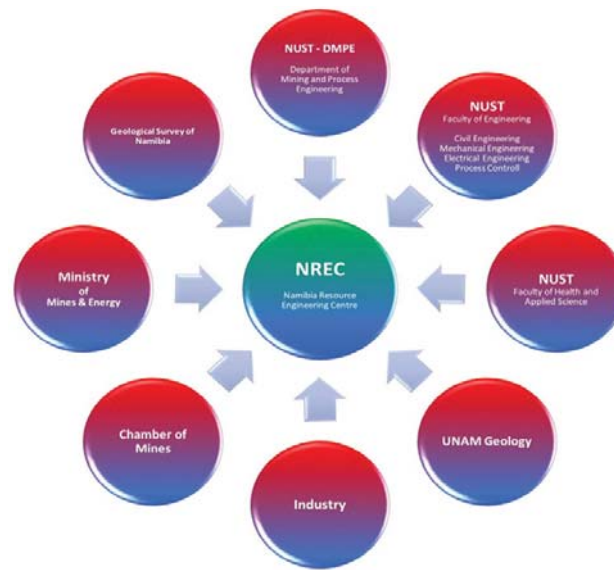


Figure 1—Structure of the Namibia Resource Engineering Centre

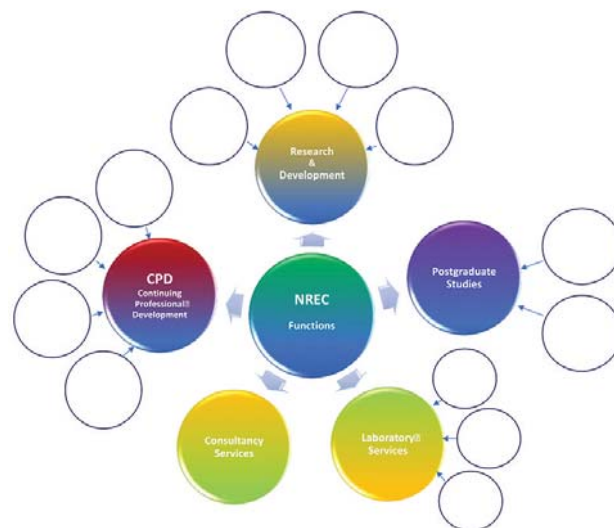


Figure 2—Functions of the Namibian Resource Engineering Centre

Namibian minerals industries, along with government organizations and communities, the NREC will become a key enabler for the nation. The NREC will become a driver of national development through partnership with resource and associated industries, coupled with government organizations and communities. The sustainability of institutions offering minerals engineering programmes depends on their ability to deliver value to local industry.

### Research and development services

The main targets of the NREC are to perform excellent multidisciplinary research and development, engage and collaborate with the Namibian industry and government as well as across the Southern African Development Community (SADC), and produce the science and technology outputs

needed to enable Namibia to leverage its natural advantage in resources. The DMPE conducts research in mining, minerals, and metallurgy, as well as safety and the environment, with the emphasis on relevance to industry and other stakeholders. The core research and development activities involve a combination of strategic basic and applied research, incorporating theory and experimentation, based upon principles of engineering, technology, and science. The DMPE will actively seek to enhance the funding base for minerals-related research with the government and industry. Minerals research today requires interdisciplinary approaches and talents. Minerals research should be driven by the enabling technologies that are fueling the high-technology revolution. To this end, the DMPE will promote interdisciplinary research and joint research initiatives with other departments at the University and its international partners. The Department has

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established symbiotic partnerships with leading universities offering mining and process engineering programmes and mining companies within the Southern African region and beyond. These partnerships have allowed the DMPE to identify key research areas, which dovetail well with the strategic intent of establishing a National Centre of Excellence, the Namibia Resource Engineering Centre, in 2019.

### Postgraduate studies

Over the next five years, the Department of Mining and Process Engineering aims to enhance its research capacity through the development of postgraduate programmes. The DMPE will continue to educate and train a new generation of metallurgical and mining engineering graduates, and plans to offer PhD and Master's degrees (by research) in applied science and engineering. These programmes will provide training, offering a choice of fundamental or applied research projects, and lead to national and international careers within the mining and allied industries. The introduction of postgraduate courses and a centre of research excellence is one option that the Namibia University of Science and Technology is pursuing as a way of sustainably producing experts in the field, from whom qualified staff will be recruited (Mischo, 2011).

### Continuing professional development (CPD)

The Department also aims to deliver short and continuing education courses to industry and associated groups. These include employee training and qualifications to improve skills, performance, and capabilities required to meet professional and career development goals. Duty-of-care and business performance dictate that employers must ensure that the education, training, and skills of their employees remain current. The DMPE has staff with appropriate profiles and cultures to provide this service to industry. Virtually all universities and research institutions run short courses, and some offer Master's programmes with extensive coursework components. The DMPE is positioning itself to be the leader in minerals education, within Namibia and beyond. Excellent short courses, in-house training, and technology transfer sessions for professional engineers and scientists are aimed at providing training in modern techniques and capabilities.

### Consultancy and bureau services

The Centre will offer first-rate consultancy services to industry and government, ensuring the rapid application of new technologies and approaches. It will offer a specialized bureau service to industry and government, using its skilled staff and extensive equipment to solve immediate short-term problems. From its humble infrastructure and equipment base of eight years ago, the DMPE is now housed in a N\$200 million, purpose-built building and equipped with multimillion-dollar modern laboratory facilities, equipment, and instrumentation. The Department has standard laboratory equipment as well as specialized equipment like a scanning electron microscope (SEM), Magotteaux mill, flotation units, an XRF facility, thin-section machine, rock sample preparation equipment, and uniaxial/triaxial testing machine, which are essential in catering for the research and development needs of the local mining industry. The

laboratory equipment is critical for teaching, research, and for consultancy purposes. The Centre will build and maintain productive partnerships with industry, business, government, tertiary institutions, and community stakeholders within and beyond Namibia.

### Conclusions

The current depressed commodity prices threaten to have a significant impact on the sustainability of minerals education. This is further compounded by the inability of governments to provide sufficient funding. The situation extends beyond the developing world and has become characteristic of institutions offering minerals engineering programmes across the globe. In order to address this challenge and ensure the sustainability of minerals education, the DMPE intends to leverage the nexus that exists between government, industry, and other stakeholders by establishing a centre of excellence in minerals resource engineering. Among its key objectives, the Centre aims to expand research activities and postgraduate studies, and offer specialized bureau services to industry and government. Through this innovative vehicle, the DMPE envisages continued growth into the future, thus contributing to the national development agenda and securing its position as a recognized centre of excellence for mineral resources engineering.

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