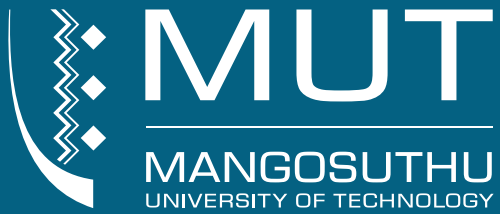


**ANNUAL
RESEARCH, INNOVATION
AND ENGAGEMENT
REPORT**

**20
22**





Project Manager: Dr Maryam Jordaan
Editors: Dr Anette Mienie,
Professor Nokuthula Sibiyi
Contributors: Dr Anette Mienie
Dr Maryam Jordaan
Mbali Mkhize
Bheki Hlophe
Photos: Bheki Hlophe
Mbali Mkhize
Ayanda Bulose
Technology Station in Chemicals Submitted
Copy editing: Elaine Young
Designers: Design Divas

shape and own the future



TABLE OF CONTENTS:

| | | |
|------|--|----|
| 1. | MESSAGE FROM THE ADMINISTRATOR, PROF LOURENS VAN STADEN | 02 |
| 2. | MESSAGE FROM THE ACTING VICE-CHANCELLOR, PROF MARCUS RAMOGALE | 03 |
| 3. | MESSAGE FROM THE DEPUTY VICE-CHANCELLOR: RESEARCH, INNOVATION & ENGAGEMENTS, PROF NOKUTHULA SIBIYA | 04 |
| 4. | MESSAGE FROM THE DIRECTOR: RESEARCH , DR ANETTE MIENIE | 07 |
| 5. | RESEARCH, INNOVATION AND ENGAGEMENT ACHIEVEMENTS | 09 |
| 5.1 | MUT RESEARCH AWARDS | 09 |
| 5.2 | NRF-RATED RESEARCHERS | 12 |
| 5.3 | PERSPECTIVES ON GLOBAL RANKINGS | 13 |
| 5.4 | ESTABLISHMENT OF AN OFFICE OF TECHNOLOGY TRANSFER (OTT) | 13 |
| 5.5 | SPOTLIGHT ON THE ACHIEVEMENTS OF WOMEN RESEARCHERS AT MUT | 13 |
| 5.6 | THREE INTERNATIONAL FELLOWSHIPS: ONE DEPARTMENT | 22 |
| 5.7 | FACULTY RESEARCH UPDATE | 23 |
| 5.8 | TEACHING AND LEARNING DEVELOPMENT CENTRE (TLDC) | 31 |
| 5.9 | COMMUNITY ENGAGEMENT | 31 |
| 5.10 | TECHNOLOGY STATION IN CHEMICALS (TSC) | 35 |
| 6. | CONCLUDING REMARKS BY THE DVC: RIE | 40 |

01 >

MESSAGE FROM THE ADMINISTRATOR, PROF LOURENS VAN STADEN

The 2021/2022 period covered by this publication demonstrates how far Mangosuthu University of Technology (MUT) has progressed in transforming itself into a respected producer of knowledge. It is impressive to see how well MUT's research continues to grow in spite of its limited postgraduate offerings, which contribute a significant percentage of research output in research-intensive universities.

Our researchers are using their limited resources to produce world-class research which promises to change lives. The research papers that have come out of MUT have moved the university from the periphery of knowledge production to a seat in the centre.

The research output from the year under consideration also tells a great story of the University's quest for collaboration at a national, continental, and global level. Co-publishing with researchers from other institutions demonstrates the respect afforded to our researchers as experts by their peers. Internal collaborations point to a healthy academic culture of mentorship, skills transfer, and knowledge-sharing across disciplines. The fact that there is always a new researcher publishing for the first time in the name of MUT is a strong sign that the university is doing a good job in shaping the next generation of researchers.



Professor Lourens van Staden
Administrator

It would be remiss of me not to acknowledge the diversity of both the areas of research captured by this publication, and the researchers themselves. This shows that MUT's commitment to research has filtered through to every level of the University. Its commitment to finding solutions to our society's most pressing challenges is a key part of its identity as a university.

In conclusion, I wish to congratulate every researcher who contributed to the University's research output for the 2021/2022 year. MUT's flag is soaring even higher because of your contribution.

MESSAGE FROM THE ACTING VICE-CHANCELLOR, PROF MARCUS RAMOGALE

<02



Professor Marcus Ramogale
Acting Vice-Chancellor and Principal

It is with great pride that we present the 2022 Annual Report for Research, Innovation and Engagements (RIE) at MUT. A key highlight of the 2021/2022 year was the appointment of a new Deputy Vice-Chancellor (DVC) into the RIE portfolio, Prof Nokuthula Sibiyi. Prof Sibiyi brings with her a wealth of experience which is assisting with the realisation of RIE-related goals stated in the University's Strategic Plan 2020-2025.

It is no secret that MUT has, in times gone by, fallen short of achieving its targets in respect of its research output. For this reason, Management is paying particular attention to this core aspect of its mandate and has put numerous strategies and interventions in place to improve its research output. These are now paying dividends in more ways than one. Besides the increased funding that is accruing to the University's coffers, I am reliably informed that this improved level of productivity among our researchers is providing them with a more fulfilling and enriching experience as it relates to their careers in the institution.

I am also pleased to hear about MUT's contribution to the Sustainable Development Goals (SDGs) our participation in these and other niche area research projects demonstrates a conscious effort on the part of our researchers to investigate and solve problems that are both relevant and existential.

The DVC's efforts in entrepreneurship and other innovation and engagement activities are also gaining traction, with tremendous interest being shown in the events being organised. These will surely manifest in one of my personal goals being met, namely, that MUT should become one of the leading entrepreneurial universities in South Africa.

Finally, let me use this opportunity to wish the DVC: RIE and her team all the best as they invigorate the research agenda at MUT. Prof Sibiyi can rest assured that RIE occupies its rightful place within the academic identity of the University.

03 >

MESSAGE FROM THE DEPUTY VICE-CHANCELLOR: RESEARCH, INNOVATION AND ENGAGEMENT, PROFESSOR NOKUTHULA SIBIYA

It is exciting that we are finally able to launch the first RIE Annual Report. The 2021 academic year at MUT was marked with many challenges when it comes to research, innovation, and engagements. The most significant was COVID-19 which had a negative impact on the University's output. Contact-based partnership engagements on an academic and community level were also limited because of social distancing requirements.

Teaching and learning (T&L), research and community engagement (CE) are the core academic activities of MUT and the pillars from which the University draws its intellectual imagination. Research, knowledge generation and innovation are core to the existence and mission of any institution that defines itself as a university. Through engagements, the outputs from T&L and research should, in turn, result in positive outcomes and impacts in the broader society. To this end, the University community is committed to the integration of CE in T&L and research.



Professor Nokuthula Sibiyi
Deputy Vice-Chancellor: Research, Innovation and Engagement

Areas of Collaborative Academic Excellence (ACAEs)

MUT aims to advance new knowledge in its research focus areas, known as Areas of Collaborative Academic Excellence (ACAEs), and to work towards the translation of knowledge through innovative endeavours. The ACAEs represent areas in which the University is further developing expertise and activities to deepen its research impact through multi- and interdisciplinary research and educational opportunities. These focus areas cut across the faculties and include strategic alliances with external partners, both public and private. The ACAEs include:

- 1. Human and Social Settlements and Development:** Holistic exploration of human and social settlements and development through education, economic and policy development, technology, the arts and humanities, and the sciences fosters discoveries that nourish both individuals and society.
- 2. Energy and Environment:** The challenges of ensuring future availability of energy resources and a clean environment on a global basis while nurturing productivity require technologies, policies, and education.
- 3. Health and Food Security:** The biomedical knowledge, technology, human resources, education, and policies required for the maintenance and improvement of health, including fighting disease and the adverse effects of aging, are of critical importance in our global society.

The above areas are approached from different angles within different disciplines and are not intended to replace or restrict academic endeavours in unrelated areas within the faculties.

Research output growth

MUT's research output increased dramatically after the COVID-19 pandemic and continues to grow. In 2021, MUT received an Excellerator Award in recognition of its excellence and accelerated research. Between 2021 and 2022, research output increased from 68.87 units (audited) to 106.32 units (unaudited) respectively. Our research output was made up of journal articles, books or book chapters, and conference proceedings as reflected in Table 1.

Table 1:
2021-2022 Department of Higher Education and Training (DHET) Research Output

| Research Output | 2021 | 2022 |
|--------------------------------------|--------------|---------------|
| DHET-accredited Journal Articles | 55.17 | 96.84 |
| Research Books and Book Chapters | 12.28 | 4.90 |
| Peer-reviewed Conference Proceedings | 1.42 | 4.58 |
| Total | 68.87 | 106.32 |

Improved staff qualifications

One of the key goals of the South African National Science and Innovation (NSI) agenda is to strengthen and expand the country's human capabilities for science and innovation. This includes an explicit imperative to improve PhD attainment by university staff, as stated in

the Department of Science and Innovation's Decadal Plan 2022. In 2008 the National Development Plan (NDP) set a target to increase the percentage of academic staff with a PhD to 75% in 2030 (NDP 2011). The Decadal Plan (2022) once again included this objective but put the spotlight on historically disadvantaged universities (HDIs), Universities of Technology (UoTs) and specifically women and black academics.

Improving the qualifications of academic staff can enhance the quality of education, as staff with PhDs have a higher level of expertise and knowledge in their field. A doctoral qualification can also lead to increased research productivity and provide more opportunities for funding and collaboration. Moreover, by producing graduates with the necessary skills and knowledge to tackle the major social and economic challenges facing the country, South African universities can play a significant role in national development.

Although MUT is far from reaching the NDP target, the University has made strides in improving its Master's and doctoral staff qualifications as indicated in Table 2. The following research capacity development initiatives for both staff and postgraduate students were carried out during the 2021-2022 academic years so that they could positively contribute to the MUT goal of increasing the University's output:

- Writing retreats;
- Postgraduate supervision training;
- Grant proposal writing;
- Identification of a research problem;
- Literature review process;
- Statistical analysis; and
- Ethics training.

Table 2:
MUT staff profile (2021 - 2022)

| Indicators | 2021 Actuals (Audited 3rd HEMIS submission) | 2022 Approved Targets | 2022 Actuals (Audited 3rd HEMIS submission) | 2022 Percentage Achievement |
|---|---|-----------------------|---|-----------------------------|
| Instructional/research professional staff | 228 | 233 | 230 | 90% |
| % staff with doctoral degrees | 22% | 18% | 26% | 144% |
| % staff with Master's degrees | 54% | 51% | 54% | 106% |

The National Research Foundation (NRF) plays a pivotal role in our research endeavours. The NRF rating system is a key driver in the NRF's aim to build a globally competitive science system in South Africa. It is a valuable tool for benchmarking the quality of our researchers against the best in the world. NRF ratings are allocated based

on a researcher's recent research outputs and impact, as perceived by international peer reviewers. The rating system encourages researchers to publish high quality outputs in high impact journals/outlets. As noted in Tables 3 and 4, there was a slight decrease in the number of rated researchers at MUT from 2021 to 2022. There was only one

new rated researcher in 2022, which this calls for greater focus on readiness programmes to support researchers in their application for NRF rating. In collaboration with the NRF, there is a planned rating information session that is scheduled to take place in January 2023.

Table 3:
2021 MUT NRF-rated researchers

| Name | Category | Faculty | Period of Rating |
|----------------|----------|-------------|------------------|
| Prof BF Bakare | Y2 | Engineering | 2019-2024 |
| Dr M Lasich | Y2 | Engineering | 2019-2024 |
| Dr BP Numbi | Y2 | Engineering | 2019-2024 |
| Dr RS Subbaye | C3 | Engineering | 2020-2025 |
| Dr H Ndebele | C3 | Engineering | 2020-2025 |
| Prof TC Haupt | C1 | Engineering | 2021-2023 |
| Dr AT Kaniki | C2 | Engineering | 2021-2026 |

Total = 7 | Current = 5 | New = 2

Table 4:
2022 MUT NRF-rated researchers

| Name | Category | Faculty | Period of Rating |
|----------------|----------|------------------|------------------|
| Prof BF Bakare | Y2 | Engineering | 2019 - 2024 |
| Dr M Lasich | Y2 | Engineering | 2019 - 2024 |
| Dr BP Numbi | Y2 | Engineering | 2019 - 2024 |
| Prof TC Haupt | C1 | Engineering | 2021 - 2023 |
| Prof AT Kaniki | C2 | Engineering | 2021 - 2026 |
| Dr F Adejoro | Y2 | Natural Sciences | 2022 - 2027 |

Total = 6 | Current = 5 | New = 1

International partnerships

International research partnerships also continued to grow over this period, and it is encouraging to note that good progress has been reported for the support role provided to principal investigators. The University's research growth has been strengthened further by its three-year MUT RIE Strategy (2023-2025), which aims to create an enabling environment to ensure excellence in research, CE and internationalisation.

In 2022, MUT entered a partnership with South Africa Sweden Universities Forum (SASUF) as a signatory institution by committing to actively participate in and contribute to the successful implementation of the United Nations (UN) Sustainable Development Goals (SDGs). The project aims to strengthen collaboration between the countries within research and education as well as to undertake joint work towards the SDGs. MUT is an equal partner among 38 universities from South Africa and Sweden. This enables MUT to participate in various research weeks by satellite, and to collaborate with Swedish universities. MUT will be connected to more than 3 000 researchers, students, university leaders and funding agencies in seminars and workshops.

In December 2022, a proposal for the establishment of the MUT Centre for Entrepreneurship was tabled at the Executive Management Committee (EMC) meeting. The Centre will serve MUT students, coordinate the offering of entrepreneurship skills to other departments within the institution, and service the community in terms of entrepreneurship development. It will also serve as a connection point between faculty, staff, students, and the community. This proposal is being made to respond to the objectives of the MUT Strategic Plan (2020-2025), which includes creating an enabling support environment. It is envisaged that this centre will inculcate an entrepreneurship culture and drive entrepreneurship activities on campus. In 2023, a series of workshops is planned for the MUT community to convey the rationale for the establishment of the centre. In October 2022, five students were funded to attend a 5-day Entrepreneurship Training event which was facilitated by the Technological Higher Education Network South Africa (THENSA).

MESSAGE FROM THE DIRECTOR: RESEARCH

<04



Dr Anette Mienie
Director: Research

Writing a foreword for our first Annual Research Report is not only humbling but also a great privilege. The ability of a university to not only survive, but to grow, is evident in its ability to adapt to change. MUT's research community was not only able to adapt during the worldwide pandemic, but we were also able to sustain our research productivity. This is evident from our research output that amounted to 46.2 research output units during 2019, increasing to 68.87 during 2021. Increased access to laboratories and infrastructure after the pandemic resulted in greater research activity during 2022 and we submitted a record number of 106.32 research output units to the DHET.

The role of the Research Directorate is to provide a supportive environment for research and innovation. During 2022, the Research Directorate supported research capacity development through the University Capacity Development Grant (UCDG). The support included: seed funding for staff members registered for postgraduate degrees, lecturer replacement for staff members on long

study leave, research workshops, national and international mobility grants, and career development grants for female doctorates. In collaboration with the University of KwaZulu-Natal (UKZN), staff members in the health sciences received South African Medical Research Council (SAMRC) capacity development grants to complete higher degrees. Further, staff members were assisted with NRF funding and rating applications as well as funding applications from various other funding organisations. The total income from these grants was R8 884 950.20.

The MUT-funded Postdoctoral Research Fellowship Programme allows for the granting of 18 fellowships. The success of the programme is evident from the increased research output. The programme will be extended to allow for 24 fellowships in 2023.

We are also proud to be part of the South African Population Research Infrastructure Network (SAPRIN). One of its Demographic Health Surveillance nodes, USINGA (Umlazi Health and Demographic Surveillance System) is based at MUT and is led by UKZN, in collaboration with the Durban University of Technology (DUT), MUT, SAMRC, Human Sciences Research Council (HSRC), the National Health Laboratory Service (NHLS), and the eThekweni Municipality. It will bring together skills to co-create an interdisciplinary and transdisciplinary platform which, while realising the SAPRIN aims and objectives, will track the demographic and epidemiological transition of a historically disadvantaged urban population.

The Women in Research Initiative, which started in 2018 as part of the UCDG, continues to be supported by the UCDG. This project also received NRF Funding (2021 to 2022). Through the Canadian Academics Without Borders Programme, a collaboration with the Carleton University in Canada was established. Through this collaboration, our initiatives were monitored and evaluated. A comprehensive Programme for Women in Research will be developed during 2023.

Although we are starting from a low research base, MUT currently owns four South African patents of which two are also protected in China. We are awaiting the outcome of these two patent applications in other jurisdictions. Further, the MUT Intellectual Property portfolio includes two trademarks. We are currently in the process of filing a provisional patent based on the disclosure of an organic herbicide was received.

When I reflect on research at MUT, I am in awe of the pioneering spirit of our research community. MUT is a young university in terms of research, and limited resources make research challenging in the sciences and engineering fields. The growth in research is due to the support from our executive management, the excellence of our researchers, the way in which researchers support each other, the establishment of research infrastructure, and collaboration with industry, government, and other universities, both nationally and internationally.

I want to thank all my colleagues in the Research Directorate, Library Services, Finance and Human Resources and Development department, as well as all other administrators who played a critical role in supporting research in so many ways



The MUT Research Team

RESEARCH, INNOVATION AND ENGAGEMENT ACHIEVEMENTS

<05

5.1 MUT RESEARCH AWARDS

2021 RESEARCH AWARDS

The MUT Annual Research Awards were initiated 20 years ago and aim to recognise the efforts of researchers over time. Scientists are therefore evaluated on their research output for the previous two years.

The following evaluation criteria are used:

- Only publication in DHET-approved journals is considered;
- Only research output and activities in the specified research area are considered; and
- Research output is measured as outlined by the DHET and researchers should have at least 3 units to be acknowledged.

Research Award and Acknowledgements Categories 2021

- **Most Productive Researchers in each Faculty**
Faculty of Engineering – Prof BF Bakare
Faculty of Natural Sciences – Dr T Mutanda
- **Runner-up to the Most Productive Researcher**
Faculty of Engineering – Dr M Lasich
- **Senate Prize**
Prof BF Bakare
- **Research Acknowledgements**

Most Published Retired Research Professor:
Faculty of Management Sciences

Prof E Mantzaris

Most Published Retired Research Professor:
Faculty of Natural Sciences

Prof A Beesham

Most Published Postdoctoral Research Fellow:
Faculty of Engineering

Dr M Akinlolu

Most Published Postdoctoral Research Fellow:
Faculty of Management Sciences

Dr SK Msosa

Most Published Postdoctoral Research Fellow:
Faculty of Natural Sciences

Dr OO Olayuyigbe

Most Published Postdoctoral Research Fellow:
Faculty of Engineering

Dr NM Mutombo

External Funding – More than R100 000, less than R1 million

Dr T Mutanda
Mrs R Pillay
Dr TJ Ajayi
Ms K Bhengu
Dr NJ Gumede
Ms M Mpaka
Mrs TP Makhathini
Dr LQ Qwabe
Ms S Nkosi
Prof TC Haupt
Mrs TC Cele

Doctoral Degrees

Dr SA Buthelezi
Dr NX Mkhize
Dr BE Mthembu
Dr O Nkwonta
Dr S Mabaso
Dr FR Nofemela
Dr M Ntuli
Dr A Oyieke
Dr K Ramsarghey

2022 RESEARCH AWARDS

The Annual Research Awards is an anticipated day which recognises the hard work of researchers at the University. On 16 September 2022, the University held its twentieth annual Research Awards ceremony to celebrate the achievements of MUT scholars producing knowledge in various fields.

Research Award and Acknowledgements Categories 2022

- **Most Productive Researchers in each Faculty**
Faculty of Engineering – Prof T Kaniki
Faculty of Natural Sciences – Prof RM Coopoosamy
- **Runner-up to the Most Productive Researcher**
Faculty of Engineering – Dr BP Numbi
- **Most Productive Novice Researcher**
Faculty of Engineering – Dr J Bwapwa
- **Senate Prize**
Prof BF Bakare
- **Research acknowledgements**

Most Published Retired Research Professor:
Faculty of Management Sciences

Prof E Mantzaris

Most Published Postdoctoral Research Fellow:
Faculty of Engineering

Dr M Akinlolu

Most Published Postdoctoral Research Fellow:
Faculty of Management Sciences

Dr Adewumi
Dr Mlambo
Dr SK Msosa

Most Published Postdoctoral Research Fellow:
Faculty of Natural Sciences

Dr A Abayomi

External Funding - More than R200 000

Dr T Mutanda - NRF R238 450.00
Prof AT Kaniki - NRF R324 000.00
Mrs TC Cele - NRF R365 000.00
Prof A Anandraj - EDTEA R500 000.00

Doctoral Degrees

Dr T Makhathini
Dr M Madiba
Dr B Nyangiwe
Dr BYC Mvuyana
Dr T Duma
Dr J Mukuna
Dr S Mtsweni
Dr A Jaieyola
Dr M Lecheko
Dr R Jama
Dr N Fuyane
Dr TE Kotelana
Dr T Kweyama
Dr V Ariyan



MUT Researchers (standing) with (seated from front left) the DUT Acting DVC: RIE, Prof Keo Motaung; MUT Acting VC, Prof Marcus Ramogale; MUT DVC: RIE, Prof Nokuthula Sibiya and Chair of MUT Council, Ms Sanelisiwe Mnyandu

5.2 NRF-RATED RESEARCHERS

The NRF rating system remains the benchmark for research excellence, bringing prestige to both the researchers who receive the award and the institution where they are based. The University has seen growth in NRF-rated researchers – from six in 2022 to an additional five researchers in 2023. The DVC: RIE, Prof Nokuthula Sibiyi, and Prof Theophilus Davies, a Research Professor in the Faculty of Natural Sciences, both received C2 ratings. Dr Ebenezer Oluwakemi and Dr Njabulo Gumede from the Department of Analytical Chemistry, and Dr Devashan Naidoo from the Department of Nature Conservation, were all Y2-rated.

Prof Nokuthula Sibiyi was congratulated by the DHET's Council on Higher Education (CHE) on the achievement of her C2. The Chairperson of CHE, Vuyo Memani-Sedile, said Prof Sibiyi's new research status was not only beneficial to her and the University, but the whole education system as well. Memani-Sedile said that the CHE takes comfort in "the knowledge that this level of expertise is available to support the work of CHE" through Prof Sibiyi's participation in the Higher Education Quality Committee (HEQC) and the Accreditation Committee.

Responding to the letter from the CHE, Prof Sibiyi said: "As the Executive responsible for Research, Innovation and Engagements, I believe in leading by example. I trust this accolade will inspire my fellow colleagues to do the same".

She was also congratulated by the University's Acting Vice-Chancellor and Principal, Prof Marcus Ramogale. Professor Ramogale said that the message from CHE was "another feather in the cap for yourself and MUT. More power to your elbow!"

NRF Excelleration Award

The annual NRF Awards recognise and celebrate South African research excellence. The awards presented to researchers fall into two categories: rating-linked awards and special recognition awards. The rating-linked awards are given to those who have qualified for an A or P rating, as evaluated through the NRF's peer review-based rating system. The special recognition awards provide a platform to honour researchers for career achievements and contributions to knowledge creation and dissemination, as well as capacity development and transformation.



MUT Senior Management with Dr Gansen Pillay from the NRF, seated, left

Amongst others, the NRF Awards include the NRF Excelleration Award for South African Research Institutions. Derived from the words, "excellence" and "acceleration", the Excelleration Award acknowledges South African research institutions who have achieved the most improved research performance over recent years, as evaluated by independent parties and measured against a selection of critical indicators.

During the NRF's annual research awards on Tuesday 2 November 2021, MUT was awarded the NRF Excelleration Award 2020/2021 - a fitting tribute to the years of work that have gone into establishing the Research Directorate from ground up and reaching this point of excellence and acceleration. The Research Directorate hosted an event in December 2021 to celebrate the achievement of this award with the MUT researchers who had contributed to the University's improved research output.

5.3 PERSPECTIVES ON GLOBAL RANKINGS

MUT stands tall among other universities for accelerating its research, as recognised by its receipt of the NRF Excelleration Award in 2021. This has provided an impetus for MUT to start opening itself to participation in global rankings.

Universities make a concerted effort to achieve good rankings as an indicator of their standing in the higher education sector worldwide. The ranking process is not automatic. Researchers are provided with an opportunity to submit reflections on their research, teaching and learning, internationalisation, and knowledge transfer. The process requires universities to be strategic and collaborate as a united force to achieve this.

MUT is currently looking at the Times Higher Education methodology as a viable option for becoming globally ranked. While the ranking avenue takes into cognisance research, teaching and learning, there is also an international outlook component which includes the proportion of international students, international staff and international collaboration at the institution (each representing 2.5% of the total rating). This is achievable at policy level and at operational level.

5.4 ESTABLISHMENT OF AN OFFICE OF TECHNOLOGY TRANSFER (OTT)

In November 2022, MUT's Research Directorate earned kudos for the University as a recipient of the National Intellectual Property Management Office (NIPMO) grant. The Research Directorate had submitted a proposal in May 2022 to enable the University to establish an Office of Technology Transfer, and was informed of the positive result six months later by NIPMO head, Ms Jetane Charsley. NIPMO's TTO Support Fund establishes and maintains Technology Transfer Offices, building the capacity of the people in those offices and empowering them to protect IP. NIPMO awarded MUT an amount of R3 595 943.00 over a three-year period for capacity building.

5.5 SPOTLIGHT ON THE ACHIEVEMENTS OF WOMEN RESEARCHERS AT MUT

The Research Directorate led by Prof Sibiyi has made notable progress in fostering the growth of women in research. Back in 2018, a Women in Research (WIR) initiative was established with the aim of providing strategies to better support women researchers at MUT via the UCDG. This initiative was later supported by the NRF through a customised grant over the years 2021-2022. An international collaboration with researchers at Carleton University in Canada, which is an Academics Without Borders project, has since commenced. This project is an extension of the UCDG initiative and will strengthen the monitoring and evaluation capacity of MUT's Research Directorate to make evidence informed. The Research Directorate hosts annual workshops for the WIR Initiative. Some achievements of MUT's women in research are highlighted below.



Prof Nokuthula Sibiyi

Prof Nokuthula Sibiyi, the DVC: RIE is leading research by example at MUT. A C2-rated scientist, she previously served as Deputy Vice-Chancellor: Teaching and Learning, Executive Dean: Faculty of Health Sciences, and HOD of the Department of Nursing at Durban University of Technology (DUT). In recognition of her excellent contribution to primary health care, she was inaugurated as a Fellow of the Academy of Nursing of South Africa in 2015. She was subsequently recognised by the Department of Science and Technology as the 2018 South African Distinguished Woman Scientist in Humanities and Social Sciences. She also received several research awards from DUT, which included Top DUT Female Researcher of the Year, Top Researcher in the Faculty of Health Sciences, and 2018 Senior Researcher of the Year. The Forum of Professional Nurse Leadership named her the 2019 Regional Nurse Leader. Her research area is primary health care with a specific focus on maternal and child health. She has published over 100 journal articles, conference papers, books, and book chapters. She has successfully supervised 60 Master's and 31 PhD students.

Dr Anette Mienie

Dr Anette Mienie, our Research Director, holds a doctorate in molecular genetics from the University of Witwatersrand and an LLB from the University of KwaZulu-Natal (UKZN). She is also an admitted attorney of the High Court of South Africa.

Before joining MUT in 2000, her research focus was on molecular and physiological aspects of drought tolerance. She has published 84 papers and co-supervised three Master's students and four doctoral students. She was also an external examiner for Master's dissertations from the University of Pretoria and the University of the Witwatersrand. Due to her interest in water use in agriculture and drought tolerant crops, she also served on steering committees from the Water Research Commission (WRC) and later on reference groups of the WRC. She was successful in attracting external funding for her research from national funding agencies such as the Protein Research Trust, SAFCOL, CARNIA, and the WRC, and from international funding agencies such as the Southern African Regional Research Network (SARRNET), the South Africa-Netherlands Research Programme on Alternatives in Development (SANPAD) and the African Regional Cooperative Agreement for Research (AFRA).

After joining MUT, her focus moved from doing research to providing an enabling environment for research. As the first Director responsible for research, she was responsible



for developing all the relevant policies and procedures as well as the regular benchmarking and review processes. Research capacity development is of great importance at MUT, and mechanisms were put in place to support our researchers to develop from novice researchers to established researchers. Funding was obtained from the Research Development Grant, the Tertiary Education Linkage Project (TELP), UCDG and NRF. Further, staff members were assisted with their funding applications to the NRF, Technology Innovation Agency (TIA), the provincial Department of Economic Development, Tourism and Environmental Affairs (EDTEA), the Medical Research Council (MRC), Eskom and many more.

Due to a keen interest in new developments and innovation, she has taken up the additional responsibility for Technology Transfer as outlined in the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008. This includes the decision on the protection of all intellectual property rights and the drafting or review of contracts, and compliance with all relevant legislation and regulations. As mentioned above, funding to establish a Technology Transfer function at MUT was secured from the National Intellectual Property Management Office (NIPMO) during 2022.

Dr Mienie also has experience in community engagement work, which has been a feature of many of the research projects she has either led or been involved in as a co-researcher. For example, some SARRNET projects funded by UNESCO were composed of national and international partners such as the ARC, the University of Zululand, and the University of Wageningen in the Netherlands. The research was multidisciplinary in nature, and investigated sociological issues related to farming (community extension and development) as well as agronomy. The projects were based in various communities in South Africa, namely Port Durnford and Hlabisa, as well as communities in Lilongwe, Malawi. More recently, she managed a community-focused project, which was the TELP-funded American Linkage project that was based at MUT.

A component of this study investigated issues of community development and research in the Umgungundlovu community. At present, policy principles, strategies and mechanisms are being considered to facilitate the integration of community engagement into research.

Dr Mienie has completed a City and Guilds (London) qualification in Quality Assurance. As a result, she was responsible for the quality assurance function at MUT for a few years before a Quality Assurance Directorate was established. This experience contributed to the development of best practices for research management at MUT and the current focus on optimising monitoring and evaluation.

During the monitoring and evaluation of research productivity, it has become evident that although there are equal research and development opportunities, women are lagging in research output, productivity and securing external income. This is what led to the development of the Women in Research (WIR) initiative described above. One of the outcomes of this was the collaboration with Carleton University through their Academics Without Borders Programme (2020 to current) and with students from the Diploma in Public Policy and Programme Evaluation (2022 to current), which led to the acceptance of a joint presentation (panel discussion) at the INORMS Conference.



Prof Busisiwe Nkonki-Mandleni

Prof Busisiwe Nkonki-Mandleni is our Director: Community Engagement and Development (CEAD). She is also a vice-chairperson of the South African Higher Education Community Engagement Forum (SAHECEF). Her responsibility as CEAD Director is to coordinate community engagement at the University by designing and coordinating the delivery of creative, compelling initiatives that build strong community connections, thus increasing the depth and relevance of MUT's teaching, learning and research. She promotes ethically accountable community engagement related research of quality to increase research output at the University.

Her own research area is in Climate Change and Adaptation. Her current research is on "Smallholder farmers' perceptions and adaptation to climate change: A case of Umkhanyakude district in KZN province of South Africa", to address the negative ramifications of climate change in female-dominated agriculture, a requirement for developing new policies and designing new interventions. For 2021/2022 she published four research articles in accredited journals. She also supervised to completion two MSc students in the field of Agriculture. She further presented two conference papers titled as follows:

- "The vicious cycle of soil erosion: Implications for climate change adaptation in South Africa." Presentation in the 55th annual conference for the South African Society for Agricultural Extension (SASAE), held in Bela-Bela, Limpopo Province, 25-27 October 2022.
- "Living our South African Histories through Afrocentric Trans-disciplinary approaches: Communities in

Ubuntu." Presentation at the annual Canadian Association of African Studies (CAAS) virtual conference, 9-10 June 2021.

Prof Nkonki-Mandleni has also been an external examiner for Master's and PhD dissertations in the field of Agriculture and Community Engagement since 2017. For 2021/2022 she was external examiner for the University of South Africa (Unisa), University of Venda (Univen), North West University and University of Mpumalanga. On 13 December 2021 she was recognised at MUT's "Thank You" celebration for researchers for her contribution to research at the University.

As part of the "SASUF Goes Digital" workshop, she organised and facilitated a workshop titled "Skills development and equitable education in an effort to address marginalized communities" on 22 September 2022.



Ms Xolile Ngubane

Ms Xolile Ngubane is the Acting Director at the Technology Station in Chemicals (TSC) at MUT. This unit provides support to small, medium, and micro enterprises (SMMEs) in chemical and related sectors. Xolile holds an MBA (2017, UKZN) and an MSc in Chemistry (2006, UKZN), and is certified in Project and Operations Management, with over 20 years' experience in SMME support through knowledge and technology transfer. She is currently registered for a PhD in Entrepreneurship at the North West University (NWU) Business School.

Ms Ngubane is a former HOD in Analytical Chemistry (1999 to 2003) and was an Inorganic and Analytical Chemistry lecturer from 1994 to 1999 at MUT. She is also an entrepreneur, having run her own project management company. On the research and innovation front, Ms Ngubane is currently working with the TSC's Indigenous Knowledge Team on the development of cosmetic products infused with local plant materials to reduce the dependency of this sector on imported raw materials. One product developed for clients is commercially available in the market.

She contributed to a paper on the "Phytochemicals, bioactivity, and ethnopharmacological potential of selected indigenous plants" in the *South African Journal of Science* in 2023. Ms Ngubane also presented on "Gender mainstreaming, Youth, COVID-19 & Rural Entrepreneurship" at the SASUF Goes Digital Workshop in September 2022. She co-presented a paper on "Township

economy: An impetus for South African economic revival, development, and transformation” at the 2022 Township Economy Conference organised by the University of Johannesburg’s (UJ) Institute for Pan-African Thought and Conversation, UJ’s Department of Sociology, and the Township Studies Research Network. In 2023, Ms Ngubane

presented on “COVID-19 Impact on Rural and Township Entrepreneurship” at the SASUF Sustainability Forum 2023 at the University of Western Cape (UWC). She also presented on “Exploring the role of innovation spaces and creating stimulants and opportunities for innovation at Universities of Technology” at MUT’s 10th Focus Conference in 2023.

Dr Thobeka Makhathini

Dr Thobeka Makhathini is a senior lecturer and researcher in the Department of Chemical Engineering at MUT. She worked as an industrial engineering technologist at Huntsman Tioxide SA for eight years before joining academia. She is a registered professional engineering technologist with the Engineering Council of South Africa (ECSA). Her research focuses on environmental engineering with a specific interest in industrial wastewater reclamation, acid mine drainage remediation, pollution control, and climate change. She has published 11 articles in numerous DHET-accredited journals in the niche areas mentioned. She is currently co-supervising a Master of Engineering student at DUT and a PhD student at UJ, both of whom are focusing on finding water treatment solutions through nanotechnology. She is also involved in CE projects that seek to assist communities with clean water access through initiatives focusing on treatment strategies for domestic wastewater. She is collaborating in projects with uMngeni-uThukela Water to support the Umhlathuze communities with access to clean water.

Dr Makhathini has recently been appointed as an NRF Thuthuka review panel member for Engineering. She obtained NRF funding for three consecutive years (2018 – 2020) to complete her project, amounting to R350 000.00. She recently secured another NRF Thuthuka funding grant to further advance her research for the years 2023 to 2025, totalling R540 000.00. She holds a PhD in Chemical Engineering from the University of Witwatersrand and other qualifications in the engineering discipline. She also gained a Postgraduate Diploma in Higher Education from Rhodes University to enhance her teaching pedagogy. In 2019 she was a recipient of a gold award in the MUT Vice-Chancellor’s Teaching Excellence Awards. She currently serves as an assessor in the ECSA education cluster.





Dr Thulile Duma

Dr Thulile Duma (known as Thuli) is a senior lecturer in the Human Resource Management (HRM) Department. She joined MUT in 2010 as a skills development facilitator in the University's Human Resource & Development Department, and in 2013 she took a position as a lecturer in the academic Department of Human Resource Management under a secondment arrangement. In 2023, she was appointed permanently as a senior lecturer in the department. She completed her PhD in 2020 in record time, with her dissertation focusing on "Experiences of Academic Success of Students with Disabilities in Universities of Technology in South Africa". She has since published four papers.

Dr Duma was accepted into the TAU (Teaching Advancement at University) Fellowship Programme, which seeks to develop academics in South Africa. This is a project-based initiative and her project is titled: "Investing in Inclusivity and Social Justice at MUT". The aim of the project is to ensure that students with disabilities are catered for, and that social justice and inclusivity matters are taken seriously at the University. She has also been involved in various CE projects. As a result, she was able to work with the DHET to establish a community college in Highflats, KwaZulu-Natal, named Khulakahle Vocational Community College. The college, established in 2021, has since been adopted by the DHET.

Dr Duma received an MUT Research Award in 2022 for completion of her PhD, as well as first and second-place awards at the 2022 Vice-Chancellor's Teaching & Learning Excellence awards (for Recognition of Teaching and Learning Advancement and Best Collaboration for a New Initiative respectively).



Dr Xolile Mkhize

Dr Xolile Mkhize holds a PhD in Food and Nutrition and works as a senior lecturer in the Faculty of Natural Sciences. She has published five papers and has over eight years of industrial experience which involved working as a food consultant for Unilever Foods South Africa, and as a freelancer for Unilever West and East Africa Region for the Knorr brand for food product development. Her food consultancy experience has involved working with other multinational food companies and launching innovative food products. She has also worked as a food editor for the eThekweni Metropolitan Municipality in Durban as part of educating citizens in the metro on food and nutrition issues.

Dr Mkhize has diverse lecturing experience in various universities in South Africa and is involved in interdisciplinary



research projects aimed at addressing food and nutrition insecurity locally and internationally. This includes working within inter- and multidisciplinary approaches on agri-food value chains with a focus on promoting the transformation of food systems to be more resilient, and building a more inclusive economy to benefit small-holder farmers, vulnerable communities and ultimately the African continent. Her research focus areas include working on indigenous crops and knowledge systems towards the advancement of food and nutrition security and health, well-being, and ecosystem management. Dr Mkhize has presented scientific papers at local and international conferences and published scientific papers within the field. She was invited by Unilever to be part of the research panel on product launch to discuss malnutrition and the

role of indigenous crops on 26 May 2023 and on the 26 August held in Durban in collaboration with Ukhozi FM.

Dr Mkhize was part of the Women and Climate Change initiative as a speaker on food security and climate change, under the theme "An Africa Devoid of Hunger". The event was held on 24 May during Africa Week and was broadcast on the 1KZN TV station on DSTV. Dr Mkhize received a scholarship in 2023 with Wageningen University in the Netherlands, in collaboration with Nuffic Southern Africa, for a knowledge exchange programme on Climate Action for Food Systems Transformation. She also serves as a committee member for the Nutrition Society of South Africa Eastern Branch.

Dr Bongekile Yvonne Charlotte Mvuyana

Dr Bongekile Yvonne Charlotte Mvuyana is currently Acting HOD in the Department of Public Administration and Economics at MUT. Her research focuses on Human Settlements and Service Delivery. Her research aims to contribute towards solutions to human settlements issues surrounding reforms in housing development in a developmental state such as South Africa. She presented a paper at the SAAPAM Conference in 2022 titled "Disaster Risk Governance and its Effects on Poor Communities: A Case of eThekweni Municipality". Another paper was presented at the MUT Focus Conference in 2022, titled "The impact of COVID-19 on teaching and learning amongst first-year entry learners at Institutions of Higher Education".

Dr Mvuyana is a member of the US-Africa Collaborative and will visit the University of Maryland and University of Delaware in the US from October to November 2023 to establish research collaborations in the areas of human settlements, homelessness, and disaster management. This initiative is part of the DHET/UCDP Future Professors Programme. In 2022, she received a silver award for Best Established Teacher at the MUT Vice-Chancellor's Teaching Excellence Awards.





Dr Bulelwa Nyangiwe

Dr Bulelwa Nyangiwe (known as Bule) is a lecturer in the Communication Department. She has mentored many lecturers in the department due to her vast experience and sound knowledge of pedagogies in the field. She holds a PhD in Linguistics from UKZN, with a thesis titled: "How About Speech Acts? A comparative analysis of speech acts and politeness in isiZulu and English for the development of business writing skills in English second language learners". Her research interests are written business communication, development of African languages, multilingualism, decolonisation and Africanisation of the curriculum in higher education. She has authored one publication and has one submitted for review from her PhD studies. She was an award recipient at the 2022 MUT Annual Research Awards for the completion of her PhD.

Dr Maryam Amra Jordaan

Dr Maryam Amra Jordaan, the NRF Administrator within MUT's Research Directorate and a researcher in Environmental and Pharmaceutical Chemistry, was awarded the Cum Laude Award during the University of Free State's (UFS) 38th Chancellor's Distinguished Alumni Awards on Saturday, 20 May 2023. The honour bestowed on Dr Jordaan by her alma mater serves to acknowledge her impressive achievements in both her personal and professional capacity. Dr Jordaan studied at the UFS from 2001-2013 where she obtained her BSc in Chemistry and Physiology, her BSc Honours, MSc and PhD degrees in Organic Chemistry. She then lectured at the UFS QwaQwa campus for five years. She joined MUT in 2016 as a postdoctoral fellow and went on to lecture for two years at MUT. She has 19 DHET-recognised publications and has successfully co-supervised one Master's student who graduated cum laude, and received the Dean's Merit Award for her academic excellence from DUT in 2022. In addition, Dr Jordaan completed a postgraduate diploma in Research Management and Administration (RMA) in 2022 and is an IPRC-accredited Research Administration Professional (RAP).

Dr Jordaan's research findings have earned her television and radio appearances globally on channels including BBC World Service, 1KZN (Channel 261, DSTV) and radio stations Jacaranda FM and Pretoria FM. Within just three years of joining the MUT Research Directorate, Dr Jordaan has proven her research and academic excellence by receiving several research awards from MUT and TIA, as well as external funding. She is part of the project team that secured a R16 812 137.00 grant alongside collaborator and research leader Dr A Gounden from the Sibusiso Bengu Development Programme to establish an Innovative laboratory at MUT. In addition, she is an avid entrepreneur, having managed her own 3D Printing and Engineering company.



Excellence

Cum Laude Award winner, Dr Maryam Amra Jordaan, with Prof Francis Petersen, UFS Rector and Vice-Chancellor, and Prof Bonang Mohale, UFS Chancellor, at the 38th Chancellor's Distinguished Alumni Awards Dinner

Sustainability Care Social justice
community



Mbali Mkhize



5.6 THREE INTERNATIONAL FELLOWSHIPS: ONE DEPARTMENT

Two Marketing and Communications (MarComms) staff members received competitive international fellowships from the German Exchange Service (DAAD), and the US State Department. MarComms Senior Director, Ms Mbali Mkhize, competed against 102 applicants for the DAAD 18-month fellowship that culminated in a face-to-face training in Germany at the University of Hannover with 29 other fellows from Africa, Asia, and Latin America. From this fellowship, Mkhize has enabled MUT to sign partnerships with two universities in India, and one university in Africa. There are currently informal collaborations with other universities in Africa and Latin America.

In addition, Mkhize also received another DAAD fellowship from Potsdam University in conjunction with selected fellows from only six South African universities. The fellowship is called the National Multiplier Training and enables those that have been trained to train others on internationalisation - a programme that Mkhize has started with the MarComms team.

Ms Zama Sishi, Director: Stakeholder Relations, received a US fellowship called the International Visitor Leadership Program (IVLP) which saw her receiving training at 13 USA universities in Washington, DC; Baltimore, Maryland; Virginia Beach, Virginia; Greensboro, North Carolina; Columbia, South Carolina; and New Orleans, Louisiana. This fellowship explored the history and current state of Historically Black Colleges and Universities (HBCUs) in the United States with a focus on university administration and best practices. Through the programme, Sishi was afforded an opportunity to meet and network with great scholars, enthusiastic people, and an amazing network in higher education both in the US and in Africa. In terms of her responsibility for student recruitment and stakeholder engagement at MUT, the IVLP programme has presented several opportunities for both her internal and external stakeholders. These include the opportunity for MUT and its stakeholders to connect with 13 universities, eight NGOs, departments, and global partners, as well as partners from diverse African universities - South Africa, Kenya, Uganda, Benin, Burkina Faso, Ethiopia, Guinea Bissau, Democratic Republic of Congo, Liberia, Senegal, and Tunisia. MUT is set to gain more partnerships through these fellowships.



Zama Sishi

5.7 FACULTY RESEARCH UPDATE

FACULTY OF ENGINEERING

REFLECTION BY THE DEAN: PROF BF BAKARE



Professor BF Bakare

The Faculty of Engineering actively promotes a culture of excellence in research and innovation. Research conducted in the faculty addresses issues around five of the United Nations SDGs:

- SDG 2 - Zero Hunger
- SDG 3 - Good Health and Wellbeing
- SDG 6 - Clean Water and Sanitation
- SDG 7 - Affordable and Clean Energy
- SDG 13 - Climate Action

The faculty has grown in leaps and bounds over the past years, which is evident from the trajectory observed in the growth in its annual research output. The year 2022 produced remarkable achievements and contributions from our faculty members and we also witnessed significant progress in various research activities and strong collaborations with industry partners. With a total of 23.25 DHET research publication units in 2022, the faculty significantly exceeded its output target of 15.50 DHET units. The faculty also secured about R2.3 million in research grants and contracts for various research initiatives by faculty members, mostly from the NRF and other funding agencies.

The Faculty of Engineering continued to enjoy collaboration with uMgeni Water, eThekweni Municipality Water and Sanitation, the Water Research Commission, and the local waste management company Dilex. A major collaboration was established in 2022 with German partners (GIX GmbH and efa Leipzig GmbH) and a local partner (Siyacanda Energy) on a climate protection and air pollution control research project which resulted in the delivery of equipment

worth about R12 million and the establishment of a Climate Change Centre at the University.

The year 2022 also saw four faculty members recognised for their contributions to the institution's research output at the Research Awards evening held on 16 September 2022. Prof Kaniki Tumba from the Department of Chemical Engineering was named the most productive researcher, Dr Numbi was the runner-up, and Prof Bakare received the Senate Award for publishing the highest number of journal articles (10) in the University in the year 2021.

The Faculty of Engineering remains committed to excellence in research and innovation. The accomplishments highlighted reflect our dedication to advancing the frontiers of engineering knowledge. I want to extend my gratitude to all faculty members, students, partners, and collaborators who have contributed to the success of our research endeavours.

PROFESSORIAL HIGHLIGHTS



Prof Paul Musonge

Prof Paul Musonge was appointed as a Retired Research Professor in the Faculty of Engineering in 2020. The main focus of his research is the valorisation of agriculture waste in order to develop new green products and processes. Specific applications lie in the areas of water treatment using natural adsorbents for the removal of heavy metal ions in acid-mine contaminated water and the formulation of bi-functional catalysts for the production of biodiesel. The materials are characterised by their physical and chemical properties and adsorption capacities for different metal

ions. Studies include the modelling to obtain optimised conditions for the processes. Bio-diesel research focuses on the use of agro-based materials to produce green energy. Prof Musonge's study investigates the use of hybrid stocks (such as mixed waste oils and virgin inedible oils) as well as catalysts of biological origin to produce biodiesel oil which is an eco-friendly fuel. His publications affiliated with the engineering faculty and staff since 2021 include 21 accredited journal papers, five book chapters, and 11 conference papers.

He has also made a contribution to capacity building in the faculty. Two staff members in the Department of Chemical Engineering have obtained a Master's qualification under his supervision from DUT, and he is currently mentoring an intern supported by the DSI-HSRC intern programme, together with a postdoctoral fellow at MUT. His collaborative National Capacity Building includes two female doctoral students, six Master's students and six BEngTech (Hons) students registered at DUT and Wits University. He is also supervising three postdoctoral fellows and two Master's students at DUT and one doctoral student at the Vaal University of Technology (VUT). He has an international collaboration via the International SA/Wallonia Brussels Federation (FNRS) and an NRF grant to the value of R500 000.00 for the period 2022-2023. He believes a vibrant postgraduate programme is a must to fully utilise the research potential of the institution.



Prof Marcel Ohanga Odhiambo

Prof Marcel Ohanga Odhiambo is a Retired Research Professor in the Faculty of Engineering. Prof Odhiambo's research interest is in Parallel and Distributed Computer Architectures (Hardware), Telecommunications (Wireless Communication Networks), Electronic Systems/Devices, Intelligent Agents, Process Control/Instrumentation, Internet of Things (IoT) and Artificial Intelligence (AI). When he was appointed on 1 October 2020, one his mandates was to mentor academics registered for postgraduate

studies in the electrical engineering discipline. He has therefore concentrated his efforts in generating research outputs using students from institutions that he is currently collaborating with.

In 2022 he co-edited a book focusing on mitigating the challenges that accompany IoTs, called *Achieving Full Realization and Mitigating the Challenges of the IoT*. His co-editor was his doctoral student, Weston Mwashita, who was studying at Vaal University of Technology. According to Prof Odhiambo, "we are at the age of advanced technological development, which has ushered in greater connectivity of various things or what experts call the IoT. This hyper-connectivity is often accompanied by various risks, especially given that new technological advancements might be breaking new ground not covered by the regulatory framework.... There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to address these concerns have begun including the development of international standards".

MUT study finds that brewery wastewater has the potential to become bioenergy

As water continues to be a scarce resource globally and the energy crisis strengthens its grip on South Africa, researchers are trying to find environmentally friendly ways of extracting the full benefits of the resources that we already have. A recent study co-authored by Prof BF Bakare, found that brewery wastewater has the potential to be turned into bioenergy because of its high organic strength, using anaerobic technology.

Prof Bakare co-authored the paper with DUT's Prof Sudesh Rathilal, Siphesihle Mangena Khumalo, and Emmanuel Kweiner Tetteh. The title of the study, which was published in the journal *Water*, was "Characterization of South African Brewery Wastewater: Oxidation-Reduction Potential Variation". Its findings are important because, although the brewing industry is essential for the South African economy, brewing wastes a lot of water: to make 1 m³ of beer, of 10-20m³ of wastewater is produced.

The brewing process includes malting, mashing, wort filtering, wort boiling, fermentation, maturation, stabilisation, and clarification. When it comes to the brewery wastewater composition, the study found that the contents of the water depended largely on the activities that were taking place at the brewery. In terms of the Oxidation Reduction Potential (ORP), the study shows that "brewery wastewater can be treated by biological processes on the basis that the reported ORP range permits biological activities".

According to the study, “the brewery wastewater treatment plant influent stream composition fluctuates significantly owing to the brewery’s in-house activities (i.e., washing of malted barley, which is rich in carbohydrates; brewing kettles; yeast fermentation tanks; as well as other beer-processing units) and the chemicals utilised. The high concentration in terms of orthophosphates and ammoniacal nitrogen could be a result of the type of acids used during brewing yeast cleaning, such as phosphoric acid and nitric acid”. The contents found in the wastewater give the brewery wastewater a high potential for it to be turned into bioenergy. These findings strike a double for the environment and for South Africa’s energy crisis which has been characterised by frequent electricity load shedding at a national level. The study was conducted at a brewery facility in the Durban area.

PhD study provides possible rural wastewater treatment technology solution

Dr Siphesihle Mtsweni, an n-Gap lecturer in the Department of Chemical Engineering, is one of several staff members who recently graduated from the University. Dr Mtsweni’s PhD title was: “Performance Optimization Modelling of a Horizontal Roughing Filter for the Treatment of Mixed Greywater”. His research was about optimising the performance of a horizontal roughing filter (HRF) system for the treatment of mixed greywater. Dr Mtsweni said the research investigated the option of domestic greywater reuse for delivering desired water quality for non-potable applications; as well as the applicability, effectiveness, and predictive ability of an artificial neural network for the operation of the HRF system.

Dr Mtsweni said the problem addressed in his research is the increasing demand for the development of appropriate and relevant wastewater treatment technology in rural and urban communities in many parts of the world, including South Africa. He said the problem is “largely exacerbated by the escalation of water demand and decreasing potable water availability”.

His research aimed to provide a solution to this problem by designing and fabricating an HRF system that can “effectively and efficiently” treat wastewater and reduce the reliance on potable water use by modelling and optimising the performance of the HRF for effective operation. One of the key points from Dr Mtsweni’s research is the use of the HRF for the pre-treatment of mixed domestic greywater, as the HRF can effectively remove pollutants and produce an effluent with desired water quality for non-potable reuse.

Dr Mtsweni believes the outcome of his research holds potential benefits for both MUT and the public in many ways. Firstly, he said, the research provides an in-depth understanding of the characteristics of domestic greywater

and the pollutants it contains, and could be used to develop more effective and efficient wastewater treatment technologies. These can be used in rural and urban areas and result in the reuse of greywater for non-potable purposes, thereby reducing reliance on potable water.

The research enabled the development of an efficient and effective pre-treatment system for domestic greywater, which in turn will reduce the cost and energy associated with wastewater treatment. It also provides insight into the potential of using artificial neural networks to model and optimise wastewater treatment processes, including the HRF, which could lead to further advances in this field. It can also be used as a monitoring tool in terms of performance and as an indicator of any quality deviation that might be occurring during the filtration.

In addition, the research has identified the most significant contributing factors to the performance of the HRF, which would enable the optimisation of the design parameters of the HRF for better performance. The findings from this research can also be used to inform future policy and legislation related to the reuse of greywater, promoting the sustainable use of resources.

Three DHET-accredited journal articles and two peer-reviewed conference papers were produced from the study. Dr Mtsweni said he chose this topic because it accurately reflects the scope of his research and its contribution to the field of wastewater treatment and reuse. Dr Mtsweni, who studied at DUT, was supervised by Prof BF Bakare who heads the Environmental Pollution and Remediation Research group at MUT.



REFLECTIONS BY THE DEAN: PROF R COOPOOSAMY



Professor Roger Coopoosamy

The Acting Dean of the Faculty of Natural Sciences, Prof R Coopoosamy, highlighted the following key areas in research which the faculty will be focusing on:

- Improving postgraduate qualifications of all staff by the end of 2024. Currently eight staff are being supported to complete their PhDs and three to complete their Master's degrees. This will increase the complement of PhDs and Master's to well over 95%;
- To improve the research output in terms of publications in DHET-accredited journals;
- To increase innovations in line with the areas of collaborative excellence;
- To submit higher degrees (Master's and PhDs) in the faculty;
- To increase the number of research productive females in the faculty; and
- To include CE in the faculty's research engagements.

PROFESSORIAL HIGHLIGHTS



Prof Theophilus Davies

Prof Theophilus Davies became a Retired Research Professor in 2020, having been a Research Professor within the institution since 2012. Prof Davies is an NRF-rated researcher who has published more than 200 research papers, and has taught and carried out research, CE and consultancy in Germany, Great Britain, Kenya, Nigeria, Sierra Leone, South Africa and Zimbabwe. As an environmental and medical geologist, he has made massive strides in the areas of staff development, breakthrough publications of Global Appeal, and environmental consultancy at MUT. In November 2022, he took delivery of a portable X-ray fluorescence spectrophotometric unit and a radiation monitor, acquired as part of a €20,000 award from the prestigious Alexander von Humboldt Foundation of Germany. The equipment has since been used to provide analytical services to graduate students and other CE workers during the period under review. The equipment will be utilised for the following earmarked projects:

- **Project 1:** The role of geo-environmental variables in understanding causal cofactors of diseases of unknown aetiology in Africa;
- **Project 2:** Bringing new dimensions into phytoremediation research at abandoned mine sites in South Africa;
- **Project 3:** Combating neonatal, maternal and child deaths from ionising radiation exposure around uranium and gold mines in Sub-Saharan Africa: A medical geology perspective; and
- **Project 4:** Health implications and mitigation of the practice of geophagy in rural communities of the Greater Durban Metro Area, KwaZulu-Natal Province, South Africa; and
- **Project 5:** Urban geochemistry of African megacities.

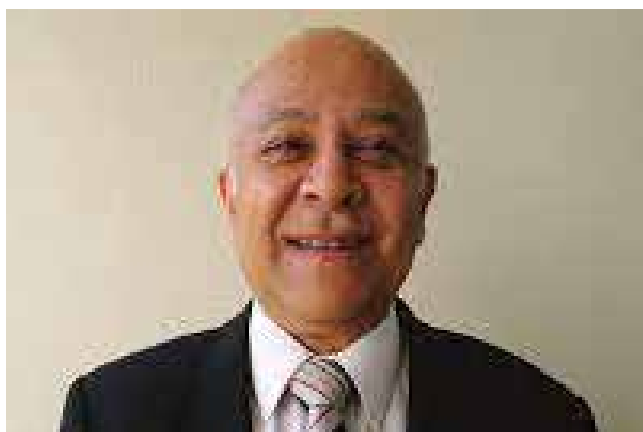
As a member of the Environmental and Health Sciences Consortium (IEHSC), Prof Davies presented a lecture to a global audience on 11 May 2023 on the seriousness of the dangers posed by gold and uranium mining. The topic of his presentation was: "Combating the effects of ionising radiation exposure around uranium and gold mining centres in sub-Saharan Africa: Focus on sensitive populations". This was part of the IEHSC Webinar Series.

According to Prof Davies, "several possible health effects are associated with human exposure to radiation from uranium, especially among sensitive populations such as pregnant women and children". Furthermore, "while all uranium isotopes mainly emit alpha particles that have little penetrating ability, the main radiation hazard from uranium occurs when uranium compounds are ingested or inhaled".

He voiced his concern that “no, or very few epidemiological studies have been undertaken so far in the Witwatersrand basin, despite the massive environmental contamination from uranium mining in that area”. Given the significant knowledge gaps on aspects of ionising radiation exposure from uranium and gold mining and milling in Sub-Saharan Africa, Prof Davies argued for researchers to be supported in acquiring the data they need to develop multi-pronged, proactive, evidence-based interventions.

During the period 2021/2022 Prof Davies published four DHET-accredited papers. He also made media contributions on MUT’s behalf on the topic of seismic activity in South Africa, emphasising that the probability of experiencing a major earthquake anywhere in South Africa is close to zero. In collaboration with Prof Akash Anandraj, Prof Davies has initiated a column in MUT’s internal news magazine, *Good News Friday*, titled the “FNS Research Oracle”, which is scheduled for delivery every first Friday of the month. This is a hugely informative and educational ‘snippet’ for all our researchers at MUT, and has become an instant hit.

To inculcating a culture of conducting research and boost research productivity in the faculty, Prof Davies initiated the launch of a regular Faculty Research Seminar Series. The series, supported by the Dean of the Faculty, was scheduled for the first Tuesday of each month, with the purpose of boosting research proposal writing and publications in DHET journals by faculty researchers. As some of our teaching staff do not have postgraduate qualifications, this seminar series offers a magnificent coaching platform for Master’s and doctoral staff candidates in the various faculty departments which is akin to graduate supervision for higher degrees. The series has been greeted with remarkable enthusiasm by the faculty and an immediate impact has been made.



Prof Aroonkumar Beesham

Prof Aroonkumar Beesham joined MUT in 2020 as a Retired Research Professor. He has over 200 publications worldwide, and has presented 168 talks at seminars, workshops, and conferences both locally and internationally. He is

currently investigating the issue of dark energy and the corresponding issue of the late time acceleration of the universe. This is one of the most important problems in cosmology today, and a mainstream problem. Despite the voluminous amount of research into this area since 1998 when it was discovered (around 53 000 papers from Web of Knowledge), scientists still do not know what dark energy is, or how to explain this acceleration. They are trying a two-pronged attack, viz., looking at some alternatives to dark energy such as bulk viscosity and Chaplygin gas, and looking at modified theories. The latter offers the possibility of explaining the current acceleration of the universe without requiring dark energy. These investigations are expected to continue for the foreseeable future and form the most important topic of Prof Beesham’s research. The rest can be broadly classified as mathematical modelling of various systems.

Prof Beesham is an associate of the National Institute for Theoretical and Computational Sciences (NITheCS) and was responsible for initiating a process that led to approximately R500 000.00 being raised in 2022 for faculty students at all levels via NITheCS.



MUT study finds local plant species holds promise in race for antibiotic against critical drug-resistant pathogen

Drug-resistant pathogens continue to be one of the biggest challenges to the global health system. To respond to this scourge, the World Health Organization (WHO) in 2017 published a list of pathogens that it described as a critical, high and medium priority in terms of the urgency of the need for novel antibiotics. The *Pseudomonas aeruginosa* (*P. aeruginosa*) bacteria was named among the three bacterial strains classified as a critical research priority.

It was the urgent need for research on these bacteria that led to a study by MUT researchers Dr McMaster Vambe, postdoctoral researcher; Prof Roger Cooposamy, Acting Dean of the Faculty of Natural Sciences; Prof Kuben Naidoo, Acting Head of the Department of Nature Conservation; and Prof Georgina Arthur, who until her recent retirement was a member of staff in the Department of Nature Conservation. Their focus was on *P. aeruginosa*, which they describe as “an opportunistic pathogen that commonly infects individuals who are immune compromised, particularly those infected with the human immunodeficiency virus and/or those suffering from cancer. It is a common etiological agent of hospital-acquired pneumonia, urinary tract infections and bacteremia”.

The study found that South African plant species could hold a potent key to the discovery of novel antibiotics against the drug-resistant *P. aeruginosa* bacteria. Titled

"South African medicinal plants screened against *Pseudomonas aeruginosa*", the study was published in the *Journal of Medicinal Plants for Economic Development*. The study reviewed ethnobotanical research conducted in relation to the pathogen. It found that only 31 studies had been published over two decades and none of these was dedicated solely to *P. aeruginosa*. Another startling finding was that none of the studies on the pathogen was published in the first three years after the WHO classified it as a critical research priority.

The study found that a total of 152 plant species had been screened against the bacterium using crude plant extracts. "It was encouraging to note that almost half of all plant species evaluated demonstrated noteworthy antibacterial activities against the pathogen," the authors explained.

In terms of phytochemical analysis, the research singled out a study that identified and isolated a compound called plumbagin from the leaves of Asteraceae. "Interestingly, the compound displayed potent bactericidal effects against *P. aeruginosa*. To the best of our knowledge, this was the only successful attempt at isolating potent anti-*P. aeruginosa* from South African medicinal plants documented over the past 20 years," confirmed the MUT researchers.

The study also reviewed research that was conducted on the feasibility of using plants in combination therapy to combat *P. aeruginosa*. Combination therapies are important, the researchers argue, because they "widen the antibacterial spectrum, improve the efficacy of clinically ineffective drugs and generally delay the development of antibiotic resistance".

Promising results had been generated by several of the reviewed studies that tested combination therapies where South African medicinal plant extracts interacted with conventional antibiotics against *P. aeruginosa*. The MUT study concluded that these combination therapies could be the quickest and cheapest way to fight the *P. aeruginosa* pathogen. "The use of drug-resistance modifying agents in combination therapies could potentially improve the efficacy and hence allow the possible reintroduction of some clinically ineffective antibiotics. From a financial point of view, this approach seems more appealing than developing novel therapeutic agents which customarily must undergo extensive efficacy and safety evaluations before approval," the researchers advised.

MUT researchers investigate the presence of hazardous metals in vegetables

A study by MUT researchers cautioned against the long-term use of irrigation water with hazardous metals

because it causes an excessive build-up of the metals in soil and crops. Co-authored by S'busiso Nkosi, a Deputy Director at the Technology Station in Chemicals at MUT, and Nomakhosa Msimango, a Control Technician at MUT's Department of Chemistry, the study was published in the *South African Journal of Science*. It was titled "Screening of zinc, copper and iron in lettuce and Chinese cabbage cultivated in Durban, South Africa, towards human risk assessment".

While the study found heavy metals to be within global limits for agricultural use in the sampled plants (lettuce and Chinese cabbage), it found that water from the nearby river which is used for irrigation was contaminated with heavy metals. "The content levels of Cu [copper] and Fe [iron] in water were measured to be 0.075 mg/kg and 0.731 mg/kg, respectively, which exceeds the WHO/Food and Agriculture Organization's standard parameters of 0.017 mg/kg and 0.50 mg/kg, respectively," the study found.

The study warned that "consumption of high levels of copper can cause nausea, vomiting, diarrhoea, gastric (stomach) complaints and headaches. Long-term exposure over many months and years can cause liver damage and death. Zinc is considered a fundamental component for human existence; however, acute and chronic exposure to excessively high concentrations of zinc can cause nausea, vomiting, diarrhoea, fever and lethargy. Excess iron in the system can cause cirrhosis when deposited in the pancreas, liver cancer when deposited in the liver and cardiac arrhythmia when deposited in the heart."

The study was conducted at The Fair Food Company and Edamame Development Programme in Pinetown, KZN. The irrigation water used in this agricultural site was collected from the Umgeni River. The study findings indicate that waste management and healthy environmental practices in the areas surrounding the Umgeni River are critical to ensure that the river is not contaminated with heavy metals.

"It is recommended that to keep the environment less affected by heavy metals, proactive health agencies, trash disposal knowledge, and best practices should be maintained," the study advised.

MUT expert highlights the significance of the role of blood in human anatomy

"Blood - that red fluid that rushes out of our bodies when we are injured. Even if this were to happen often, we would never get used to it. We might just get scared when we see it. We might even cringe when we talk about it but we seldom give a thought to its role in human anatomy."

During February – possibly best known for Valentine’s Day – MUT’s Biomedical Technology Lecturer, Venishree Nundkissor, noted the important role played by blood in our survival. She paid homage to this vital fluid during what MUT has adopted as the Month of Love because of its symbol being the heart.

“Blood carries vital nutrients and oxygen to all the cells and removes waste and carbon dioxide, which is harmful to the body, and thus homeostasis is maintained. As soon as these processes are defective for whatever reasons, disease sets in. For example, if the brain does not receive oxygen within a few minutes due to perhaps a clot occluding the flow of blood, then the person ends up with an ischemic stroke,” said Nundkissor. She explained that the human body uses the heart for transporting blood throughout the body.

Nundkissor said that some of the common blood diseases are anaemia and leukemia. She explained that anaemia is a disorder that affects the red cells in the blood because of iron deficiency. The red cells become smaller than normal due to a lack of iron and “thus cannot perform their function well; this could lead to hypoxia”, which is a deficiency in the amount of oxygen reaching the tissues. Hypoxia can cause patients to experience fatigue, weakness, pale skin, shortness of breath, headaches, dizziness, and brittle nails, among other symptoms. Treatment includes iron therapy, and the iron stores usually take about three months to be replenished. “Consult your doctor so that you don’t end up with iron overload,” cautioned Nundkissor.

Social learning interventions key to the successful introduction of new agricultural crops

A recent study by MUT academics found social learning interventions to be necessary for any success in introducing new agricultural crops that contribute to nutritional diversity and fight food insecurity. The study – “Introducing grain legumes for crop diversification and sustainable food production systems amongst urban small-holder farmers: food and nutrition security project in KwaZulu-Natal, South Africa” – was published in the journal of *Agroecology and Sustainable Food Systems* Volume 46, Number 6.

It was co-authored by Dr Bonginkosi Mthembu, the HOD of Community Extension at MUT; Dr Xolile Mkhize, a senior lecturer in the Department of Community Extension; Prof Wilna Oldewage-Theron of Texas Tech University; Prof Carin Napier, the Director of Research and Postgraduate Support at DUT; and Kevin Duffy, Director of the Institute of Systems Science at DUT.

The study found that “social learning interventions through partnerships, meetings, workshops, knowledge exchanges,

as well as trial demonstrations provided farmers with knowledge and skills on various legume crop management techniques”.

It also found that training farmers on the nutritional benefits of legumes shifted their mindsets with regard to enhancing crop diversification and managing legumes from production level. The study added that the change in mindsets was necessary for sustainable land management.

According to the researchers, “The study demonstrated that the farmers could adopt new behaviours of accepting and adapting towards legume diversity within their production systems. Continuous commitment and compliance within the planting seasons were part of the positive behaviour shifts that can have an environmental impact. However, this only occurred provided that continued support was given and that they had access to basic services and inputs such as seed, water, and soil enrichment fertilisers.”

The study also contributes to efforts to enhance food security and increase legume consumption, an important and environmentally friendly source of protein. This is because of the “stronger correlation between female farmers and successful production of legumes”. Women play a vital role in influencing the consumption of legumes.

The study was conducted at Mariannhill, northwest of Durban, with urban smallholder farmers. The farmers involved in the project previously only planted vegetables and relied on the municipality to make seeds available to farmers, which limited what these farmers could plant. Urban smallholder farmers were chosen because of their potential to “increase and improve food and nutrition security in urban areas”.

Dr Mthembu and Dr Mkhize’s study acknowledged that although social learning interventions were key to successfully introducing new crops, water shortages and pest infestation needed to be addressed.



REFLECTIONS BY THE DEAN: DR BHEKA NTSHANGASE



Dr Bheka Ntshangase

Strategic interventions have resulted in the Faculty of Management Sciences increasing its research activities since 2020. One of these is the introduction of weekly faculty research seminars, where different research themes/areas are presented to enhance and assist staff to better understand research. This benefits all staff members, but specifically those who are registered for Master's and doctoral degrees.

Furthermore, the faculty's Retired Research Professors are assisting colleagues who are doing their Master's and doctoral degrees. This has resulted in an increase in the number of academic staff graduating with higher degrees. The faculty is also conducting writing retreats to capacitate the academic staff in writing for publication in accredited journals. As a result, the faculty's research output has increased drastically from 2021 and 2022. In the last quarter of 2022 the Faculty of Management Sciences became the leading faculty in terms of research output for the first time.

A current challenge is that the faculty does not yet have Master's and doctoral programme offerings, which limits research activities and funding. However, the faculty is in the process of introducing such programmes by 2028.

I am proud to share the following departmental highlights for the 2021/2022 years:

- In the **Department of Accounting and Law**, lecturer Ms EL Bentswana co-authored a book titled Core principles of accounting - An introduction in 2022. Ms Nadia Latiff, a junior lecturer who is currently registered for her PhD, published a paper during 2021, titled: "Water-related sustainability reporting practices amongst South African mining and non-mining corporations" in Environmental Economics, Volume 12, Issue 1. She also submitted a conference paper.

- **The Department of Communication** published 14 journal articles and two staff members received their PhDs.
- **The Department of Human Resource Management** published 26 journal articles and two staff members received their PhDs.
- **The Department of Marketing** published 33 journal articles, of which postdoctoral researcher, Dr Msosa, contributed to 22 and received the award for the "Most Published Postdoctoral Research Fellow: Faculty of Management Sciences" at the MUT annual Research Awards in 2022. Dr Msosa and Mr Shange each published a book as well. Mrs LC Martin received her PhD and Mr BB Mhlongo received his Master's qualification during the period.
- **The Department of Public Administration & Economics** published 22 journal articles and 2 staff members graduated with their Master's qualifications.
- **The Dean's Office** published 32 articles and five books.

PROFESSORIAL HIGHLIGHTS



Prof Evan Mantzaris

Prof Evan Mantzaris is a Retired Research Professor in the Faculty of Management Sciences. In 2022 he co-authored a research paper on health sector corruption by legal practitioners, which received enormous publicity. The article was titled "Legal Profession and Corruption in Health Care: Some Reflective Realities in South Africa" and was published in the journal *Frontiers in Public Health*. He has published numerous articles, chapters and books since his appointment at MUT and received the prize for the Most Published Retired Research Professor in 2021 and 2022 at MUT's annual Research Awards.

For Prof Mantzaris, one of his most challenging but also successful responsibilities has been the building of relationships and provision of support to all staff members pursuing PhDs. He focuses on mentoring for theoretical and empirical challenges and realities, which are particularly pertinent for middle-level staff members.

5.8 TEACHING AND LEARNING DEVELOPMENT CENTRE (TLDC)

STRENGTHENED TUTORING IS VITAL FOR STUDENT SUCCESS, RECOMMENDS MUT STUDY

It is widely accepted in academia that tutoring forms an integral part of any university's academic support system. This is more so in the case of South Africa where a growing number of students who are underprepared for university, join higher education institutions at the beginning of every year in search of academic success.

In an attempt to strengthen academic support to students and stop the 'revolving door' syndrome in higher education, where large numbers of students drop out without completing their qualifications, a study was conducted by Dr Phiwayinkosi Gumede, Acting Senior Director: TLDC, and Mr Mashango Sithole, Coordinator for Peer Assisted Learning and Foundation Provision in the same department. The study, published in the Perspectives in Education journal, identified the reconfiguration of the tutoring programme as a possible solution to improving student support.

Gumede and Sithole's study proposes that a critical support for students is a "sustainable and effective tutorship programme, characterised by qualified and well-trained tutors, stable policy, adequate resources, effective coordination of the activities, and cooperation among key role players". The study contends that the tutoring programme should be approached as a system with interrelated components which work together towards a common objective. It proposes a tutoring programme as a subsystem with three pillars: Inputs, Transformation and Output.

"Input" encompasses the key resources, role players, beneficiaries, and structure (tutoring policy). According to the study, the development and implementation of the tutoring policy is "the bedrock of implementing a tutorship programme, as it ensures standardisation and point of reference for coherence, without which the stability of the programme may be compromised". The authors caution that as much as policies are important, periodic reviews of these policies is essential in ensuring that they respond to changes in external and internal environments.

The bulk of the work happens in the second pillar, "Transformation". This is where tutors are recruited, trained and given the necessary support to effectively render their tutoring duties. This is also where the coordination of the tutoring programme takes place; tutoring policies are developed, implemented and reviewed; tutorial venues are allocated; and the whole programme is monitored.

The "Output" of all these efforts would be a sustainable and effective tutoring programme with qualified and well-trained tutors, stable policy, adequate resources and effective coordination. The most critical elements of this tutorship system are funding, coordination, tutors and policies. An investment in these elements is necessary for the tutoring programme's efficiency and sustainability. "Tutorship should be considered an integral part of the university system with adequate allocation of resources and efficient coordination of the tutorship programme activities. Long-term sustainability is pertinent, considering that tutorship programmes are one of the key interventions put in place by universities to ameliorate poor student success challenges and are part of student support and development mechanisms," the study recommends.

5.9 COMMUNITY ENGAGEMENT

Community engagement at MUT is the active involvement of the University in the community, through its academic and support staff, students, and alumni. As part of the University's Anchor Strategy, it has strategic partnerships with the broader community to enrich learning and research, prepare engaged citizens, and contribute to the public good. Engagement initiatives aim to transform the lives of individuals and communities through active involvement with MUT's stakeholders by building relationships; conducting dialogues focused on common goals; and extending university knowledge, resources and expertise that contribute to the advancement of society. Initiatives that MUT carried out in 2021/22 included, amongst others: the encouragement of the Scholarship

of Engagement at MUT; various CE projects; the Umlazi History Project; partnerships with local government and communities; and awards for excellence in CE. These are described briefly below.

SCHOLARSHIP OF ENGAGEMENT

To encourage the Scholarship of Engagement at MUT, the CEAD Directorate capacitated academic staff, exposed them to various platforms and offered support.

Staff capacity-building

The CEAD Directorate supports the Co-Operative Education

Directorate in rolling out Service Learning, which is a form of Applied Learning at MUT. Service-Learning attempts to combine learning objectives with community service to provide a realistic and open-minded learning experience for students while meeting the needs of the identified communities. Applied Learning has been endorsed in the MUT Academic Identity document (2015) as having several benefits for students, including the opportunity to acquire a deeper appreciation of the relationship between theory and practice. Service Learning further provides students with deeper understanding of the complexity and ambiguity of real-world contexts while improving their social responsibility and citizenship skills. To support staff members in integrating CE into teaching and learning and research, the CEAD Directorate facilitated training by experts from Stellenbosch University, UKZN and Univen during the period 2021-2022.

The Service-Learning training had a twofold purpose: (i) the identification and training of champions for Service-Learning, and of MUT academic staff at large and (ii) exposure to relevant Service-Learning platforms. The purpose of training champions was to allow them to participate in piloting Service-Learning projects while sparking interest among their peers. The purpose of exposing staff members to relevant Service-Learning platforms was to link them to various networks (such as the South African Higher Education CE Forum and South Africa Research Education Action Research) to learn from their experiences.

The capacitation of academic staff from Community Engagement and Cooperative Education departments as followed by the identification of priority projects to pilot Service Learning. The CEAD Directorate and the responsible academic staff agreed on two modules from the faculty of Natural Sciences in the Department of Environmental Health. The CEAD Directorate then collaborated with internal stakeholders (the Quality Management Directorate, TLDC, the Department of Environmental Health and the Co-operative Education Directorate) to assist the two academic staff members in the design of a Service-Learning module or its integration into an existing module.

Development of a training programme

The CEAD Directorate is in the process of developing a training programme: "Introduction to CE" with the assistance of the TLDC. The purpose of the programme is to enrich teaching and learning, while enhancing students' graduate attributes, by capacitating staff on the skill of integrating CE into teaching and learning and research. It is also intended to guide research with communities in the co-creation of new knowledge. The programme will build on the research skills of academic staff and students through the use of engaged research methods and constructivist

approaches to learning. It is hoped that at the end of the training programme, participants will be able to better understand themselves and the communities, as well as their responsibilities to help build those communities in response to previous injustices. Academic staff members will also be able to better understand their identity in the academic space.

eThekwini Service Learning Forum sessions

To strengthen Service-Learning at MUT, the CEAD Directorate encouraged academic staff to attend weekly eThekwini Service-Learning Forum sessions as way of learning best practices and increasing networks. The sessions emanated from MUT's memorandum of agreement (MOA) with the eThekwini municipality, whose aim is to grow Service Learning as a field of practice in the municipality. The sessions involved sharing, critique and enhancing knowledge and good practices of Service Learning for all involved.

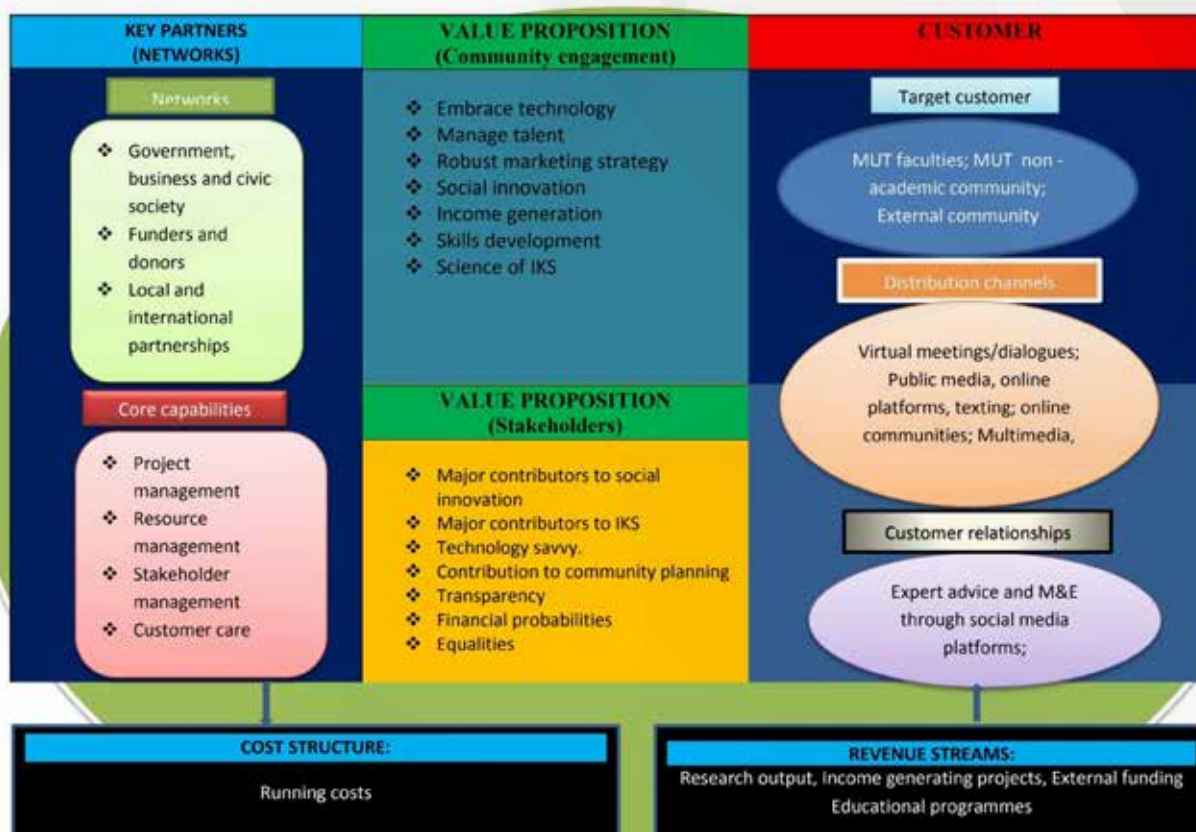
Community Engagement projects for the period 2021-2022

Notwithstanding the negative impacts of the COVID-19 lockdown, it presented the opportunity to engage with our communities remotely and to sustain such opportunities after the lockdown. One opportunity that arose was to review the CE business model to introduce a differentiated value proposition, re-evaluate our priorities regarding our target customer/community, change our distribution channels, revisit the modalities of our customer/community relationships, and review our networks. This is because MUT is part of the global economy and must be agile enough to adjust to new trends brought about by COVID-19 and the Fourth Industrial Revolution (4IR). The change in the business model has been acknowledged as key in improving the delivery of CE at MUT.

UMLAZI HISTORY PROJECT

As way of delivering on the MUT Anchor Strategy, the CEAD Directorate partnered with UKZN and a local civic organisation to curate the history of Umlazi. The aim of the Umlazi History Project is therefore to preserve the history of Umlazi by embracing local arts and culture and encouraging projects that showcase the local talents and creativity of the Umlazi community. Specific objectives are to curate the history of Umlazi by developing projects that address the true identity of the Umlazi community, more especially among the youth, and that give the Umlazi community a voice to address and correct the systematic exclusions brought about during colonialism, apartheid and the democratic era.

COMMUNITY ENGAGEMENT BUSINESS MODEL



With funding from the NRF, MUT jointly hosted a conference with UKZN to showcase the history of identified communities, including Umlazi, on 6–9 December 2022. The theme of the conference was “Engaging the World through the African perspective”. The conference was a collaboration of five universities, namely, MUT, UKZN, Central University of Technology (CUT), Queen’s University, and DUT. It was also supported by Umsunduzi District Municipality, eThekweni Municipality, eThekweni History Museum, Freedom Park, and other community-based organisations such as Ma’at Institute and Clermont KwaDabeka Tourism Development. The purpose was to restore the history of identified communities through forming collaborative partnerships, and to find new ways of conducting research with a particular focus on the Afro-centric approach. Importantly, the conference aimed at redefining CE through the participation of communities in research and CE projects, enabling learning to be decolonised and the importance of cognitive justice to be recognised.

The Umlazi community shared stories of the evolution of the township across the various eras, namely:

- the **Pre-Colonial Era (before the 1850s)**: Evidence of early life, merchant ships stopped along Durban Bay, shipwrecks, Mfecane/Difaqane, King Shaka, Cele Clans – Magaye, ‘Esiklebheni’, ‘Isibulungu’, Isaacs, Francis Farewell, Fyn.
- **Colonial/Missionary Era (1850s–1950s)**: British Colonial rule, Inkosi Ngxabhashe, Anglican/ABFM Missionaries – Bishop Colenso, Rev Champion, Dr Newton Adams/Adams College, Dick King, Ndongeni, Union of South Africa, Rev Garland Mdhlahla, Inkosi Skhwama, Early schools, Mass resistance, Slums clearance, Lamontville and Umlazi GG, entanglements of cultures, contradictions of religious beliefs, tensions, resistance to Christianity and education.
- **Apartheid Era (1950s–1993/5)**: Nationalist Party victory, Intensification of Segregation Policies, Umlazi Glebelands, Umlazi New Township, Influx control and pass laws, Bantu Education, mass resistance, politicisation, polarisation, political conflicts, gangsters, township schools of excellence, confluence of cultures, African Christian faiths – Hlabazihlangane, eMakhehleni, BCM, 1976 uprisings, 3rd-Force sponsored black-on-black violence, sports, arts and culture, successful black businesses, professionals, academics.

- **Post-Apartheid Era (1993/5 - Present)** - RSA Constitution of building a united, non-racial, non-sexist, prosperous, globally competitive nation. Successes, failures, challenges, aspirations...Democratic elections, #FeesMustFall, 2010 World Cup, Schools of Excellence, Kasi Lifestyle, MUT, shopping malls, slums, crime, alcohol and drug abuse, rampant unemployment, gross inequalities, hopes and struggles for a better life.

The afternoon sessions were on reflections which, among others, revealed that there was a great need to document the history of various parts of the country, and that the Umlazi community was prepared to share its history with institutions of higher learning. The reflections also revealed the huge role that libraries could play in preserving the history of our communities, including that of MUT. This initiative was intended to ensure that MUT is the centre/repository for the history of Umlazi. The conference concluded with a clear indication that history projects are an imperative, thus providing justification for a history project to be embarked upon.

PARTNERSHIPS WITH LOCAL GOVERNMENT AND COMMUNITIES

A total of six partnerships were established and maintained during the period. They were:

- Moses Kotane Institute;
- Vumengazi Traditional Council;
- eThekweni Municipality;

- Ubhavu Social Outreach Programme;
- Impilo Home for the Physically Challenged, Orphaned and Abandoned Children; and
- Ikamva Youth Organisation.

COMMUNITY ENGAGEMENT EXCELLENCE AWARDS

On 10 December 2021, MUT under the leadership of Dr Makua as Acting DVC: Teaching & Learning, hosted the Community Engagement Excellence Awards event with the intention of encouraging CE and making it an important aspect of MUT's approach towards teaching and learning and research. The event was hosted to acknowledge and appreciate the MUT community for its interest in and commitment to CE; to contribute to the development of a culture of excellence in CE at MUT; and to commit the MUT community to complying with the University's Strategic Goal 3: Excellence in Community Engagement. Those eligible for awards were:



Prof Nokuthula Sibiyi

- MUT staff and students that were involved in CE during the period 2017 to 2020. Those who qualified to receive awards were staff academic members who sustained leadership in working with community organisations to address critical community concerns; who extended University knowledge and skills to identified communities; and who demonstrated the effectiveness of a community project in a targeted community;
- Student volunteer(s) who provided a consistent and reliable service based on testimonials from beneficiaries; who took part in student volunteerism and went the extra mile; and who demonstrated the skills of leadership, being a team player, social skills, interpersonal skills and problem solving;
- MUT community members (academic staff, support, and students) who demonstrated innovative ways of conducting CE during lockdown due to the COVID-19 pandemic and continued their engagement with communities with greater flexibility, without compromising COVID-19 safety measures; and
- MUT non-academic staff who provided support in the socio-economic development of communities and developed and advanced the income-generating skills of the communities.

5.10 TECHNOLOGY STATION IN CHEMICALS (TSC)

The Technology Station in Chemicals (TSC) is tasked with the responsibility of providing support to Small, Medium and Micro-Enterprises (SMMEs) whose core business is the manufacturing of chemicals and related functions. The financial year 2021-22 presented some unprecedented challenges which threatened the station's ability to deliver on its mandate. These ranged from the negative effects of the COVID-19 global pandemic to the civil unrest of July 2021, which left several clients struggling to survive.

The introduction of lockdown regulations in 2020, which restricted the movement and gatherings of people, affected the TSC as it had to minimise face-to-face interactions, which were its primary mode of engagement with its clients. This also meant that some clients had challenges in accessing the manufacturing testing and analysis infrastructure of the TSC. The TSC needed to re-strategise and package its services differently to continue operating, including supporting SMMEs remotely through a variety of media.

In addition to limitations on face-to-face interventions and travel, the year was also characterised by job losses and rising unemployment. This meant many SMMEs could not afford the services offered by the TSC, yet they also needed its support in terms of manufacturing highly in-demand sanitisers at the right standard. The TSC had to revise its costing model to ensure its services were affordable to SMMEs, thus ensuring continuity of its operations and those of SMMEs and contributing to the preservation of jobs.

In July 2021, South Africa was hit by looting and violence which led to most economic activity being suspended for over a week, particularly in KwaZulu-Natal. This meant limited activity for the TSC during the month of July, the second quarter of the financial year, and negatively impacted on the well-being of its clients.

Despite all these setbacks, the TSC still managed to soldier on and meet most of its targets. During the reporting period, the TSC is proud to have contributed two publications, an area that has been lagging for the past few years on the TSC scorecard. We are proud of this achievement and plan to forge ahead and improve in this area.

The continued support of the Technology Innovation Agency (TIA) through the Technology Stations Programme Unit and the Executive Management of MUT is much appreciated and is the propeller for the TSC to continuously work hard on improving its operations. The ISO 9001:2018 Quality Management System flag is still flying high as the TSC once again passed the surveillance audit conducted by the South African Bureau of Standards (SABS) during the year.

CLIENTS ASSISTED IN LEARNING PROGRAMMES

MUT's TSC is accredited by the Chemical Industry and Education Training Authority (CHIETA), to provide a skills programme for unemployed youth. The following Learnerships are currently being offered by the TSC:

- GETC: Chemical Operations NQF Level 1;
- NC: Chemical Operations NQF Level 2;
- NC: Chemical Operations NQF Level 3; and
- FETC: Chemical Operations NQF Level 4.

The TSC hosted 39 learners for Chemical Operations Learnership NQF Level 1-4. The Chemical Operations Learnership classes began on 11 November 2021 and all learners attended the induction programme and were issued with learning materials for their respective levels.

MASTER'S AND DOCTORAL STUDENTS SUPPORTED BY THE TSC

Master's degree study: "A comparative investigation of the phytochemical profiles and bioactivities of Agave Angustifolia and Agave Sisalana plants in KZN" - Mrs NG Mkhize

This project was about assisting a client, Somkhanda Trading (Pty) Ltd, with substantiation of the claims that the client makes on his products. To achieve this, the project was assigned to a TSC staff member as a Master's degree project.

Master's degree study: "A comparative study between electrocoagulation and natural bio-polymer (CHITOSAN) in the treatment of motor oil effluent" - Mrs GE Ngcobo

This project aimed at developing an oil-in-water purification process for a client (Dilex Purification cc.). A TSC staff member was appointed to handle this task through a Master's degree programme. The second chapter of the Master's degree was completed and reviewed during the period. The research samples (crustacean shells) were pulverised and portioned into different micron sizes.

Master's degree study: "Biocatalytic depolymerization of lignin from industrial wastewater mill using lignin-degrading bacterial enzymes" - Ms Z Jobe

Mr Nkosi is co-supervising a Master's student registered with the University of Zululand (Department of Microbiology). The student was housed at the TSC for sample collection, isolation and preliminary screening of ligninolytic bacteria and further screening of ligninolytic bacteria and enzyme activity assay.

PhD study: "Uptake of Selected Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) by Plants from Contaminated Water and Soil" - Mr S Nkosi

Mr Nkosi is registered (4th year) for a PhD with the Chemistry Department at DUT under the supervision of Prof Phumulani Mdluli (DUT), Dr Promise Mahlambi (UKZN) and Prof Luke Chimuka (Wits University). The research work is being undertaken in the TSC laboratories for the use of high-performance liquid chromatography (HPLC), centrifuge, pH meter, and solid-phase extraction equipment, while other experiments are undertaken in DUT laboratories. The PhD is 75% complete.

PhD study: "The development of a framework for technology business incubation for sustainable growth of small businesses in KwaZulu-Natal province" - Ms X Ngubane

Ms Ngubane is registered for a PhD (Year 3) with the North-West University (NWU) Business School, under the supervision of Prof Stephan van der Merwe (NWU). Literature review chapters have been submitted and the university has granted ethical clearance. Interviews are currently underway.

PhD study: Chemistry - Mrs H Ndaba

Mrs Ndaba is registered for a PhD with the Chemistry Department at UKZN. The research work that is being undertaken in the TSC laboratories involves the use of an ultrasonic bath, centrifuge, oven, pH meter and laboratory incubators.

INTERNSHIP: TSC-HOSTED INTERNS

The TSC hosted six interns for the 2021/22 financial year as part of the Work Integrated Learning (WIL) arrangement between MUT and the Technology Localisation Implementation Unit (TLIU), which is an initiative of the Department of Science and Technology. With support from MUT's Cooperative Directorate, the TSC hosted another three new interns from March 2022: one from Chemical Engineering (Honours) at Unisa, one from the Chemistry BTech at MUT and one from the Biomedical Sciences Advanced Diploma at MUT.

COSMETICS LABORATORY

The TSC's Cosmetic section assists SMMEs by offering a training course on cosmetic theory and product manufacture; new product development or product improvement of cosmetic products based on Cosmetic, Toiletry and Fragrance Authority (CTFA) guidelines; and facilities for toll manufacturing. The laboratory has been instrumental in the internship programme as the interns were actively involved in the development of clients' projects (anti-blemish lotion and cream). They were exposed to the skills of cosmetics formulation and product development. Their current P2 projects involve the determination of the presence of bioactive phytochemicals (flavonoids, tannins, phenolic compounds, glycosides, steroids, terpenoids, and saponins) in some botanical oils used in cosmetics.

TSC PLANT MANUFACTURING FACILITIES

TSC plant manufacturing facilities were utilised for the manufacturing of 500kg of liquid hand sanitiser for MUT to assist the university in preventing the spread of COVID-19.

CHEMICAL MANUFACTURING TRAINING COURSE

The TSC has provided its in-house chemical manufacturing training short course to a total of 72 clients, surpassing its target of 60 - a 120% achievement.

CLIENTS ASSISTED THROUGH TSC SERVICES

The TSC assisted 13 clients for the period, falling short of its target of 40 due to a greater focus on SMME training as the need for this service was high.



COLLABORATION WITH OTHER TECHNOLOGY STATIONS

The TSC has collaborated with UJ's Process, Energy and Environmental Technology Station (PEETS) in a project focusing on "Materials science and nanotechnology for addressing environmental, climate change, agricultural, food and energy issues". A project proposal has been sent to the NRF for funding consideration, while the project leaders are looking at other possible funders to take the project forward. Plans are under way to install or develop a waste management laboratory within the TSC to tackle waste management issues facing KwaZulu-Natal while contributing to renewable energy.

COLLABORATION WITH UNIVERSITY DEPARTMENTS

Dr M Achilonu of the TSC is collaborating with Prof M Sedibe (Agriculture Department, Agronomy) of CUT in Bloemfontein for research and student supervision. The MUT-CUT collaborative engagement includes:

- **Bioremediation of Cadmium-contaminated soils using Arbuscular mycorrhizal fungi**
This is a study of the effect of Arbuscular mycorrhizal fungi (AMF) on the agronomic, physiological, and biochemical parameters of barley (*Hordeum Vulgare L.*) grown on Cadmium-contaminated soils of Iran. It was carried out in Tehran, Iran. The project is completed, and the results obtained formed a basis for future studies under open field conditions. A research article, "Arbuscular mycorrhizal fungi used to mitigate against

cadmium contaminated soils cultivated with Iranian Barley (*Hordeum vulgare L.*)" was published in *Applied ecology and environmental research*, 2022. The TSC was involved in sample preparations and analytical analysis using its UV-vis and small laboratory equipment. The affiliated institutions are MUT, CUT and Tarbiat Modarres University, Iran.

- **Chemical Analysis of Samples: Antioxidant activities, qualitative and quantitative evaluation of phytochemical content of Cowpeas and African potato samples**
The TSC evaluated the phytochemical composition of the plant samples (Cowpeas and African potato) sourced from students' projects. The phytochemical extraction procedures were conducted using an ultrasonic bath, orbital platform shaker and centrifuge machine. The qualitative phytochemical constituent screening was

carried out to determine the presence of tannins, flavonoids, phenolics, terpenoids, steroids, glycosides and saponins in the samples using standard laboratory protocols. The quantitative analysis evaluated the total contents of phenolics, flavonoids and tannins of the plant materials as well as their antioxidant content using a UV/Vis spectrophotometer instrument. The project is completed.

- **Chemical Analysis of Samples: Antioxidant activities, qualitative and quantitative evaluation of phytochemical content of *Artemisia afra***

The phytochemical extraction of twenty samples submitted to the TSC was facilitated with the ultrasonic bath. The qualitative phytochemical constituent screening was carried out to determine the presence of tannins, flavonoids, phenolics, terpenoids, steroids, glycosides and saponins in the samples using standard laboratory protocols. The quantitative analysis and antioxidant activity tests are under way.

FINANCIAL CONTRIBUTION TO THE TSC FROM INDUSTRY/PUBLIC SOURCES

CHIETA Strategic project for rural SMMEs

The CHIETA has paid an initial tranche to the value of R81 810.00 to initiate this project. This project is currently

ongoing and a second tranche invoice to the value of R245 430.00 has been submitted to the CHIETA for payment.

SEDA Umnambithi

The TSC has been engaging the Small Enterprise Development Agency (SEDA) in Umnambithi (Ladysmith) with the aim of formalising and regulating our cooperation through a memorandum of understanding (MOU). At the core of the collaboration is the intention to harness the service offerings of both organisations to allow SMMEs to receive holistic support that will benefit and advance their businesses. The University's legal office has recommended the draft MOU and it is currently under review by the principals of the SEDA. The project will commence in earnest in the financial year 2022-2023.



TSC Interns during the year



CHALLENGES, RISKS AND REMEDIAL ACTIONS

Engaging Consultants on TSC Projects

A fresh database of service providers that can be easily contracted by the University was developed with the support of MUT's Procurement Department. This was a strategic response to challenges experienced by the TSC in procuring working materials on time and of the desired quality. While this intervention is yet to bear fruit for the Cosmetics section challenges, the CHIETA projects have benefitted greatly from the initiative.

Detergents Manufacturing Pilot Plant

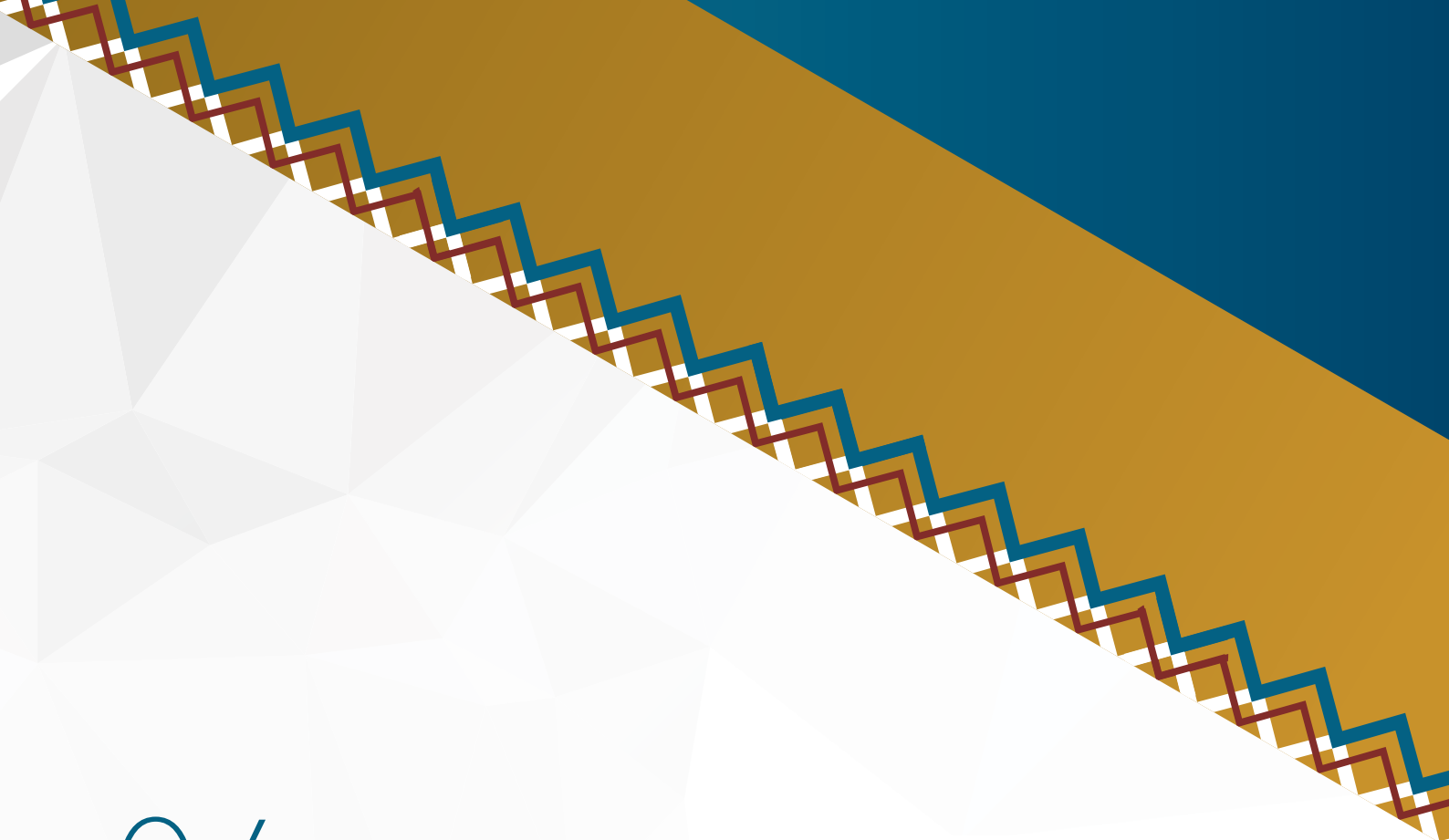
The commissioning of the two newly installed manufacturing tanks (500L & 300L) has been concluded. However, the Pilot Plant refurbishment project is yet to be initiated by the University's Maintenance Division.

EXTERNAL STAKEHOLDERS

The TSC participated in Innovate Durban's Youth Innovation Challenge 2021 as a host partner. The challenge

required the young innovators to present creative ideas that will address the United Nations SDGs. The initiative provided the University with an opportunity to partner with different stakeholders and promote youth innovation and development.

The TSC started by hosting about 30 participants from 11 teams for a workshop focused on assisting the participants to refine their ideas and pitches. This workshop took place at MUT from 20-23 September 2021. The next stage was the first-round virtual pitching of innovative ideas by the teams. On 7 October 2021 four MUT-hosted teams were successful in the first round of adjudication, namely the Green Corridors, Ubuntu Fibre, Young Redeemers and The Dream Crushers.

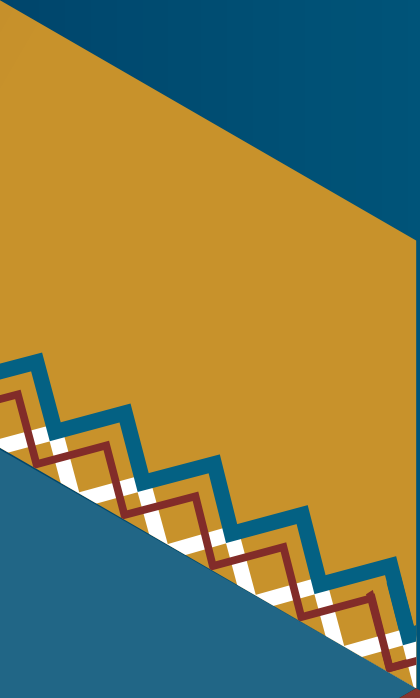
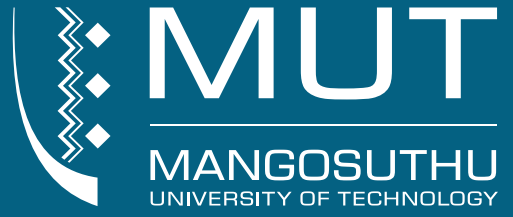


06 >

CONCLUDING REMARKS BY THE DVC: RIE

.....

To conclude, I want to extend my sincere appreciation to all MUT researchers, as well as research administrators at all levels, including the faculties and our partners, for their contributions in putting MUT on huge national and international platforms. We look forward to growing our RIE impact significantly as our efforts in this space gain momentum.





MUT

MANGOSUTHU
UNIVERSITY OF TECHNOLOGY

PHYSICAL ADDRESS

511 Mangosuthu Highway, Umlazi, Durban, KwaZulu-Natal 4, 031

POSTAL ADDRESS

P.O Box 12363, Jacobs, 4061

CONTACT DETAILS

+27 31 907 7111 | info@mut.ac.za | www.mut.ac.za

