

**NELSON MANDELA**  
UNIVERSITY

**RESEARCH &  
INNOVATION**

Report

2021/22



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# Message from the Vice-Chancellor

Professor Sibongile Muthwa

It is with pride that we present this report which showcases our excellence in research. Our students and staff demonstrated agility, commitment, and determination in persisting with our core academic missions, including producing high levels of research, over the past two years during the global coronavirus pandemic.

**N**elson Mandela University's Vision 2030 foregrounds our aspiration to contribute to sustainable futures through cutting-edge research and innovation. Complex global challenges such as climate change, pollution, environmental degradation, water-, energy- and food insecurity, and escalating poverty necessitate that universities respond at global and local levels as catalysts for development.

The University pursues the three indivisible dimensions of sustainability – economic, social, and environmental – in an integrated manner for the benefit of all people and the planet. This was recognised in the Times Higher Education (THE) Impact Rankings in 2021, which assess the performance of universities in contributing to the UN Sustainable Development Goals (SDGs). To position Mandela University as a champion of sustainability in line with our vision, mission and values, we are in the process of establishing a transdisciplinary Sustainability Sciences Hub with a uniquely African focus.

The University currently hosts 16 research chairs and 22 research entities, which contribute to several of Vision 2030's distinctive intellectual niches and strategic trajectories, including:

- Mandela University's medical school was launched in November 2021 and is the tenth in the country and the second in the Eastern Cape. It is located on our Missionvale Campus in Gqeberha and is uniquely positioned with its comprehensive primary healthcare approach, which focuses on the four pillars of disease prevention, health promotion, treatment, and rehabilitative medicine. Through an interprofessional educational approach, Mandela University aims to develop socially conscious medical doctors who can compete globally but who also have a deep commitment to improving the health outcomes of the least serviced communities locally, regionally, and nationally. An exciting new addition to the Medical School is the research chair in nanomedicine launched in 2021 and headed by Dr Steven Mufamadi. He has developed a transdisciplinary nanomedicine platform for Master's and PhD students from different disciplines. They are pursuing ground-breaking research, including a robot that cleans the environment, by sucking air polluted with harmful bacteria and viruses, including COVID-19.

- Mandela University is making excellent progress in implementing its five-year strategy to position the University as a premier destination for transdisciplinary ocean sciences research and innovation. Developing our ocean sciences niches leverages off existing strategic advantages such as our five NRF-funded SARCHI (South African Research Chairs Initiative) Chairs and research entities. Collectively, they advance pioneering research and innovation in support of global, continental, and national endeavours to unlock the economic potential of the oceans in a manner that promotes sustainable livelihoods for marginalised coastal communities while protecting planetary ecological integrity.
- Revitalising the Humanities is integral to the overall academic strategy of the University to reimagine the transformative



potential of all disciplines in the pursuit of transdisciplinary African scholarship. With a focus on decoloniality, indigenous knowledges and interrogating Western hegemonies, the Faculty of Humanities intentionally views Africa as a source of knowledge production to diversify and deepen the arts, humanities, and social sciences canon and scientific knowledge base respectively.

- Reimagining transformative engagement is gaining traction through the work of our engagement entities and the Hubs of Convergence, which provide a physical and intellectual space of convergence between students, academics, and marginalised communities to address persistent challenges such as inequality, poverty, food insecurity, and gender-based-violence. Externally-focused networks and connections with civil society and community-based organisations, government, and the private sector, have been strengthened to become more impactful in advancing engaged scholarship and innovation.
- Gender and women studies are foregrounded as part of the University's commitment to attitudinal and social transformation through the promotion of women empowerment, gender equality and equity, which are essential for democracy and a priority given that gender-based violence (GBV) is one of the most intractable crises confronting South Africa. The Centre for Gender and Women Studies is addressing this ongoing societal scourge by advancing intellectual leadership in foregrounding African women's biographical thinking, intellectual production, and political histories. This scholarly work has been significantly bolstered by our multiple award-winning SARChI Chair in African Feminist Imaginations, Professor Pumla Gqola.

In addition to the above strategic trajectories, the Transdisciplinary Institute for Mandela Studies (TIMS) and the Chair for Critical Studies in Higher Education Transformation (CriSHET) constitute key intellectual differentiators for the University. Our partnership with the Nelson Mandela Foundation, the primary custodian of the Mandela legacy, has significantly catalysed these scholarly endeavours. This includes curriculum transformation that embraces decolonisation and humanising pedagogies to ensure that the University is responsive to the pressing social, economic, and environmental developmental priorities of our country and continent.

Several other milestones have been celebrated during the period under review. The Centre for Non-Racialism and Democracy (CANRAD) celebrated its ten-year anniversary in 2021, while the University's internationally renowned engineering innovation hub, eNtsa, celebrated its 20<sup>th</sup> year. From a team of four twenty years ago, today eNtsa has a team of 70, including engineers, scientists, physicists, office professionals, research associates and students, all engaged in pioneering local and international research.

Various programmes are being implemented to expand our postgraduate pipeline and diversify our academic staff profile in line with the University's transformation imperatives. Among the targeted strategies to stimulate postgraduate enrolment growth, efforts are being made to secure external funding

for postgraduate bursaries and scholarships accompanied by student recruitment drives that position our institutional research themes and niche areas. Furthermore, various programmatic interventions are in place to improve the postgraduate qualifications profile of our academic staff and to attract socially diverse, talented scholars with Doctoral qualifications and postgraduate supervision experience to the University.

The expansion of the global footprint of the University specifically prioritises forging and strengthening South-South international linkages and expanding our African footprint. The African expansion programme initiated by the Vice-Chancellor seeks to advance the recruitment of students from those previously uncharted parts of the African continent, while also revitalising our relationships with countries and regions where we have traditionally drawn the bulk of our students. This will also serve to encourage intra-Africa student and staff mobility initiatives that are key to advancing our research and innovation agenda through internationalisation.

The expansion of the global footprint of the University specifically prioritises forging and strengthening South-South international linkages and expanding our African footprint.

The University will continue to make strides in pursuit of its vision to be recognised for its leadership in generating cutting-edge knowledge for a sustainable future. In so doing, we will engage in equalising partnerships with our stakeholders in communities, government, industry, business, and civil society organisations to co-create a more inclusive, socially just world that honours the legacy and values of Nelson Mandela.

This report showcases some of the exceptional research and innovation undertaken by Mandela University during the 2021/22 period. I wish to express my heartfelt gratitude to all our staff and postgraduate students for their ongoing commitment to living our values. I also extend my heartiest congratulations to the winners of the 2021 research and innovation excellence awards for their outstanding achievements.



# Learning, Unlearning, and Relearning

## Message from Dr Thandi Mgwebi

Deputy Vice-Chancellor: Research, Innovation and Internationalisation

Nelson Mandela University is a vibrant and globally engaged institution. We are innovative in our thinking and we have a track record of embracing change. We celebrate diversity, have a strong commitment to social justice and pride ourselves on offering a rich and enabling learning and research environment for our students and staff.



Our research successes continue to translate to strong bonds and linkages with society. We aim to pursue emerging areas of research capability, ensuring that we play a key role in helping drive the knowledge for global futures.

Moving forward, we aim to implement a comprehensive global strategy, strengthened by our existing strong international partnerships and alliances. It is our desire to deliver impact in education and research for the benefit of our local communities.

Our rising profile as a research active university comes with a renewed responsibility. We must continue to evolve as our people continue learning, unlearning and relearning. One of the core pillars of the research and innovation strategy is the strong focus on internationalisation and collaboration with international partners so that we remain globally relevant while working on local and continental solutions. We have made great progress in this regard and have positioned ourselves as a partner of choice in areas such as sustainability, food security and law.

As researchers in Africa, our people need to create knowledge that addresses the multiplicity of grand challenges the continent faces. This is a renewed responsibility that the University is embracing with enthusiasm. Whether these challenges be climate change, unemployment, population growth or developing sustainable cities, our input is needed at an ever-increasing pace.

# Message from Directors of Research and Innovation

Dr Priscilla Mensah (Research Development), Dr Kwezi Mzilikazi (Research Support and Management) and Dr Nqobile Gumede (Innovation Office)

By 2021, the second year into the COVID-19 pandemic, the Nelson Mandela University research community had learnt many valuable lessons and was functioning quite effectively despite the challenging conditions brought about by the pandemic.

Support for high-level skills development is important for accelerating South Africa's transition to an innovation-led, knowledge-based economy. Over the past year the Office of Research Development implemented various initiatives in pursuit of an enabling environment that enhances postgraduate student success and accelerates the career advancement of emerging researchers.

Through the Black Academics Advancement Programme (BAAP), seven staff members were funded in 2021 to pursue their doctoral degrees or postdoctoral research. The NRF's Thuthuka programme has been funding emerging researchers for over a decade, with 14 grant-holders in 2021. The Nurturing Emerging Scholars Programme (NESP), which was launched in 2019, is currently in its second phase and the University has been allocated four NESP positions, two of which have already been filled.

The 2021 New Generation of Academics Programme (nGAP) cohort at Nelson Mandela University consisted of 14 Black academics, of whom nine are women. With respect to distribution across faculties, Humanities, Science and Education lead with three each, followed by Engineering with two, while Health Sciences, Law and Business and Economic

Sciences have one each. Targeted funding to support emerging academics is also offered through the DHET-funded University Capacity Development Grant (UCDG) which was awarded for the new 2021–2023 funding cycle. A call for applications was published for the Nelson Mandela University internal research grants, which comprise the Conference Travel Fund (CTF), the Teaching Relief Grant (TRG) and the Research Development Fund (RDF). During the 2021 academic year, one CTF, 11 TRG and 11 RDF awards were approved at a combined investment of R780,000. Of the 23 grant recipients 15 (65%) are Black and 12 (52%) are women. These funding initiatives were complemented by a suite of workshops on a wide range of research and supervision-related topics.

The hard work of our academics, postdoctoral and research fellows, research chairs, entities, research associates and honorary appointees, saw Nelson Mandela University research outputs continuing on an upward trajectory for the fifth year in a row, registering a 4.2% increase between 2020 and 2021. In part, the Research Publication Management System increased the efficiency of the submission of the research outputs, contributing to this positive growth. The number of academics applying for ratings continues to grow. Of the 20 new applications submitted in March 2022, nine were new



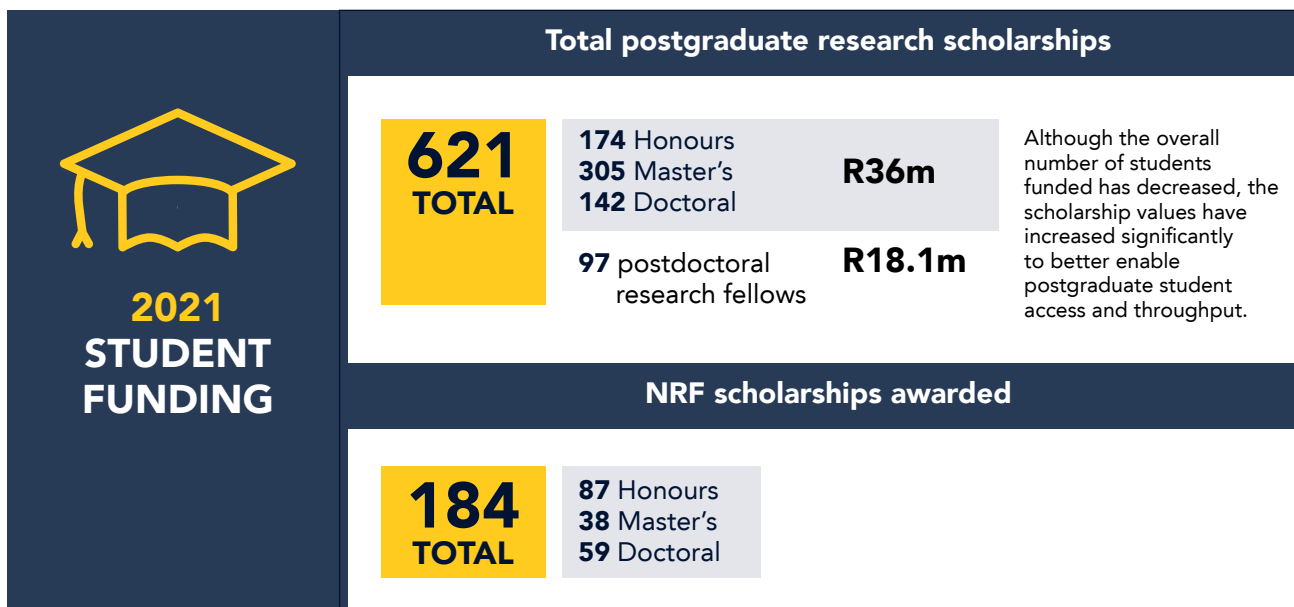
Dr Nomakwezi Mzilikazi



Dr Priscilla Mensah



Dr Nqobile Gumede



applicants, while the rest were submitted for re-evaluation. The rating system remains one of the key indicators of research stature in the South African national system of innovation. The growth of the number of rated researchers, as well as the transformation of the rated researcher cohort, continues to receive our focused attention. Our University has made notable strides in the transformation of research leadership. In 2017 only 25% of the chairs at Nelson Mandela University were Black, while 31% were female; in 2022, Mandela University boasts 50% Black and 43% female research chairs.

We are pleased to report on the highly successful establishment of the DSI-Mandela Nanomedicine Research Platform in October 2021, based at our Medical School and led by the Chair, Dr Steven Mufamadi. In the year since the research platform was established, Dr Mufamadi has successfully set up the laboratories, characterised by a customised infrastructure, set up office space, procured research equipment and recruited research and administrative staff, as well as recruiting postgraduate students, interns and postdoctoral fellows. National and international collaborations have been activated, whilst internally, the Chair is functioning as an effective model for cross-faculty training and transdisciplinarity.

The academic and research community at Nelson Mandela University was successful in applying for various external grants in diverse fields. The University's research and innovation strategy identifies the facilitation of nominations as a mechanism for building and strengthening the research profiles of emerging and established academics. In September 2022, Professor Darelle von Greunen, Director of the Centre for Community Technologies, received the NRF Award for Public Engagement in Research. This award is in recognition of contributions in enhancing the public's engagement with science and its applications in society. Professor Syden Mishi, Business and Economic Sciences, received an NRF Research Excellence Award for an Emerging Researcher, which was awarded in recognition of excellence in knowledge creation and dissemination. In addition, Professor Pumla Dineo Gqola, SARChI Chair in African Feminist Imaginations, received the

coveted NIHSS Best Non-Fiction Monograph award for her 2021 book, *Female Fear Factory*.

The University, through several innovation enabling entities, implements programmes and services targeted at both students and staff, to encourage innovation and facilitate the translation of research outputs to products and services that have national and/or global societal benefit. During 2021, in line with the University's intellectual property (IP) policy and South Africa's intellectual property rights legislation, the University – through its commercialisation vehicle, Innovolve – was pleased to share a significant portion of the revenue generated through commercialisation of IP with the product creators.

Mandela University's commitment to support innovation and entrepreneurship extends well beyond its own internal environment. Driven by this commitment, in 2021, through the activities of the University-founded business incubator, Propella, the University received 361 applications for information technology (ICT) venture incubation support, of which 55 ventures were onboarded and supported. Also a first for the ICT programme was the successful launch of a crowdfunding campaign on Indiegogo in the USA. Another programme offered by Propella is the industrial venture incubation programme, and one of the highlights for 2021 is the progress made by the Prosthetic Engineering Technologies venture. This enterprise is getting their much-needed product closer to being market ready, and successfully finalised the third prototype of their lower-cost silicone liner for prosthetic limbs. This product is positioned to replace the more expensive, imported liners. Marginalised amputees, who currently use socks to protect their limbs, which results in a high rate of microbial infections, will therefore soon have access to a safe, hygienic alternative.

As leaders of some of the University's most inspiring initiatives, we commit ourselves to continuously improving our efforts to provide an enabling environment for research and innovation, in service of society.



# Message from the Executive Dean of the **Faculty of Business and Economic Sciences** Professor Hendrik Lloyd

For the Faculty of Business and Economic Sciences, the whole notion of sustainability is shaped by the manner in which we, as an engaged university in service to society, pursue this goal and ethos in our research.

**T**his has guided our research orientation for the 2021/22 period, which is solution-seeking by nature and encompasses several core aspects:

- To foreground research in the business environment that can serve to uplift and enhance the livelihoods and sustainability of local and regional businesses and communities;
- To engage with the 4IR from a business perspective, based on the standpoint of building our research around human and environmental centredness for a better tomorrow;
- To pursue research that contributes to the development strategies and plans of our local and provincial economy and country at large, and to contextualise our research within an African and African continental scholarship paradigm. Expanding our partnerships with municipalities, communities, local, national and international businesses and agencies with an African footprint is central to achieving the desired outcome.
- To pursue high-impact, inter- and transdisciplinary research with a focus on environmental, social and governance (ESG) issues. This research speaks to the whole notion of future-oriented sustainability that finds its roots in the Sustainable Development Goals and how these goals relate to sustainable business practices, the impact of business on the environment, and how to create a platform for green business practices and green financing.
- To expand the African leadership focus by including doing business in Africa, thereby underpinning the symbiosis between corporate South Africa and continental Africa, especially considering the newly created African Continental Free Trade Agreement. This will grow the African footprint and reach of the faculty, a key priority in implementing both its vision and the University's Vision 2030.

Digitalisation has played an important part in advancing our faculty's reach. During the 2021/22 period, most of our research was online and we facilitated a wide range of webinars and conferences with increased participation, and, most importantly, a greater diversity of participants, national and international, including universities, corporates and business. People could participate from wherever they were situated, without the time and financial cost of physically attending. Since the pandemic





restrictions were lifted earlier in 2022, we have been hosting hybrid conferences to maintain the best of online and physical participation.

A major focus for us is to align our whole research endeavour with a value chain of sustainability-focused research activities produced by our staff, master's and doctoral students. This creates an informed frame of reference that can be used in transforming our learning and teaching practices through module development with a sustainability and resilience focus.

As part of this shift, we are drawing on postdoctoral fellows, honorary, emeritus, adjunct and visiting professors as mentors for emerging researchers and younger staff to grow our research output, collaborations and enhance the faculty's research culture.

Over the past year, we have strengthened trans-institution, trans-organisation and transdisciplinary research, such as our ocean sciences collaboration, in which maritime management and economic development is linked to the multi-stakeholder ocean sciences sector across the socio-economic spectrum.

As part of this collaboration, Weliswa Matekenya and Professor Roney Ncwadi – both from the School of Economics, Development and Tourism – conducted research on the impact of maritime transport financing on total trade in South Africa. Their findings suggest that a continuous, sustainable, substantial investment in maritime transport has the potential to promote trade flows in South Africa. We recommend more investments in maritime transport infrastructure to ensure a significant increase in exports, and to stimulate economic development in South Africa.

Entities aligned with the faculty, such as the Family Business Unit, Unit for Economics, Development and Tourism, and the Unit for Positive Organisations, are expanding on inter- and transdisciplinary research that impacts society at large.

Through our faculty-wide entrepreneurship and family business focus, our research aims to create a positive spin-off that directly links to people's livelihoods and how to co-create communities that are more sustainable, resilient and economically viable in terms of their current business practices.

In this context, Professor Syden Mishi and Dr Godfred Anakpo from the School of Economics, Development and Tourism, undertook research titled 'Challenges Facing ICT Use in Times of COVID-19 Pandemic: The case of small businesses in South Africa'. COVID-19 and its related restrictions have led to the closure of over 60% of small, medium and micro enterprises (SMMEs), largely due to their inability to move from a physical to an online business model. In this study, the researchers examined the ICT challenges of SMMEs, coping strategies and the road map for redress in South Africa.

The Department of Business Management carried out research on entrepreneurship and family business initiatives and on growing financial inclusion in communities, based on the

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research in the Department of Development Studies, headed by Professor Stephen Margo. 'Policy roadmap for a sustainable informal business sector', a paper Prof Margo co-authored with Dr Florah Modiba, was published in 2022 in the journal *Development in Practice*.

In 2022, Dr Modiba also co-authored 'The role of microfinance institutions in enhancing the sustainability of women-owned SMMES', with master's student Kundai Koti, which was published in *Investment Management and Financial Innovations*.

Prof Syden Mishi's and Dr Godfred Anakpo's research project, 'The Global Economic Impact of the Russia-Ukraine War: Implications for the South African Economy and Sustainable Development Goals' provides insight into the economic impact of the war and makes policy recommendations for redress in the South African context. The conflict has led to worldwide shocks affecting energy supply, commodities and trade. This has far-reaching implications for the South African economy, in terms of growth, employment, poverty and energy, and is thus a severe threat to the country achieving SDG 7 (Affordable and Clean Energy) and SDG 8 (Decent Work and Economic Growth).

In closing, we congratulate Nelson Mandela University's 2021 Researcher of the Year, Professor Andrew Phiri, featured elsewhere in this report. He is doing groundbreaking work in the econometrics field. Prof Phiri is a prolific, innovative researcher, on the cutting edge of developing and exploring new techniques in the field. He personifies the new thinking and new direction that can take our country forward.

# Message from the Executive Dean of the **Faculty of Education** Dr Muki Moeng

All forms of sustainability are underpinned by education, and in 2021 and 2022 we introduced exciting new areas in the Faculty of Education to ensure we live up to our ethos of inclusivity and a humanising pedagogy.

**B**ased on our multilingual approach to teacher education, we are collaborating with the Faculty of Humanities in developing a new system of supervising postgraduate students in their isiXhosa mother tongue. In 2023 we will pilot supervision in both English and isiXhosa for the honours programme and will expand from here to be able to offer supervision solely in isiXhosa to postgraduate students whose mother tongue is isiXhosa.

The reason for the initial English/isiXhosa combination is that even if you are a first language isiXhosa teacher, the academic language for supervision in the vernacular is very different to conversational language. It requires linguistic translation of supervision techniques, which Professor Linda Kwatsha from the Department of Language and Literature, Faculty of Humanities, has been workshoping with us, spearheaded by our Faculty's Head of Department of Postgraduate Studies, Professor Shervani Pillay.

We are increasing our general support for undergraduate and postgraduate students. In September 2022 we held a symposium on the pedagogy of care, focusing on how we can better assist first years in their transition into higher education, with all seven faculties invited. To support postgraduate student research, we have assessed the feedback from external examiners over three years and are addressing areas that need attention, such as methodology, theoretical frameworks and literature reviews.

Prof Pillay has initiated a support system of ongoing online postgraduate research workshops, which will be compulsory from 2023. Research specialists from different universities lead the workshops. The postgraduates' supervisors also attend, to develop a common understanding of what the student needs.

Since the start of the COVID-19 pandemic, we have significantly increased and refined our online workshops, programmes and symposia, but with the return to classes in 2023, we will combine a strong person-to-person component with online, which is a completely different pedagogy.

In certain situations, online is the most suitable option, such as our advanced Technical and Vocational Education and Training (TVET) diploma, which we started streaming to eight centres around the country pre-pandemic. We are currently



developing two completely online programmes, either one year (full-time) or two years (part-time).

One is the advanced diploma for TVET lecturer development, for TVET lecturers who don't have a teaching qualification, which we started working on in 2019 with funding from the Department of Higher Education and Training. The other is our postgraduate certificate in education (PGCE). The necessity for these two programmes is that South African schools are so desperate for teachers that they employ graduates without a teaching qualification, and we want to close this gap.

Another national issue is that many TVET lecturers are not digitally prepared, and we are busy developing a short learning programme in computer literacy, which we are aiming to start in 2023.

Moving to our work in schools, the pandemic amplified the structural inequalities in our education system. Even before the pandemic, 75% of our schools – predominantly those in socio-economically marginalised communities – did not deliver the same quality of education as those in middle-class communities.

For over ten years, the Centre for the Community School (CCS) in our faculty has been collaborating with a number of working class and rural schools in the greater Nelson Mandela Bay and rural Eastern Cape.

With a grant from the National Research Foundation to support postgraduate students, the CCS has been developing theoretical and practice-based models of school improvements that are relevant and responsive to the realities and socio-economic issues of schools and the communities they serve. In partnership with the IKamvelihle Development Trust (iKDT) in Cala in the rural Eastern Cape, the CCS has been engaging with four schools for several years – two high schools and two primary schools.

In Nelson Mandela Bay, the Manyano Network of Community Schools, which has supported education in working class areas for many years, is one of the CCS's key partners. There are currently 12 Manyano schools and in 2021/22 their work has expanded to Motherwell township in the Nelson Mandela Bay Metro, which has 32 primary and high schools.

Levels of maths and science in the majority of government schools in South Africa is of major concern, so the faculty has undertaken a number of initiatives to help overcome this.

- In 2021/22, Professor Anass Bayaga, the faculty's STEM (science, technology, engineering and maths) cognition specialist in secondary school teacher education, published 12 co-authored articles in this field. He has launched a series of STEM webinars in which students and lecturers, local and international, present on different facets of science and maths education, such as mathematics anxiety and the use of games to facilitate learner understanding in the foundations of maths and science.

- Rouxan Claassens, fourth year (B Ed (SP & FET)) student teacher presents a webinar that explores mathematical teaching approaches that help learners overcome their anxiety about maths, and replace this with a sense of freedom and confidence in mathematics.
- Fourth year (BEd: SP/FET (Science)) student teacher, Bhambalele Nyathi, who is from Mount Ayliff in the rural Eastern Cape, is another webinar presenter. When he first came to Mandela University he was part of our maths support programme because he battled with English, and he is now absolutely flying in maths. His webinar identified problems that hinder learning of mathematics in secondary education and offered alternative strategies to overcome this.

“ ... the CCS has been developing theoretical and practice-based models of school improvements that are relevant and responsive to the realities and socio-economic issues of schools ... ”

Meanwhile, with the help of Dr Bruce Damons, Mandela University's Director of Engagement, who was the Director of the CCS for many years, I have been researching the area of service learning and what is expected of student teachers in terms of contributing to social change and social justice. Very important practical considerations come up, such as girl learners not attending school because they are menstruating. The CCS is helping to address this by supplying donated sanitary pads to schools for their female students. We also engage on general hygiene and wellness at schools, for which we collaborate with the Faculty of Health Sciences.

Finally, to enhance our research and publication output, the faculty's Deputy Dean, Dr Tulsi Morar, initiated 'brown bag' lunchtime seminars from March 2022 where new researchers present their research to faculty members.

Dr Morar also leads the faculty's three-day research writing retreats where senior researchers work with new researchers developing articles or book chapters. Dr Morar follows up on commitments made by the researchers to complete their work. Two of our lecturers, Dr Lucky Maluleke and Dr Ayanda Simayi, attended these retreats and both graduated with their doctorates in April 2022.

# Message from the Acting Executive Dean of the **Faculty of Engineering, the Built Environment and Technology** Professor Dalenca Pottas

The previous Dean of the Faculty, Professor Barend van Wyk, was appointed as Deputy Vice-Chancellor: Teaching, Learning and Technology at the Tshwane University of Technology, commencing 1 September 2021. Prof Dalenca Pottas has been Acting Executive Dean since then.

**A**s a faculty, we honour master's student Ziqamo Mpi, who was tragically killed in a motor vehicle accident during 2021. He was part of the Advanced Mechatronic Technology Centre (AMTC), supervised by Professor Theo van Niekerk and Professor Russell Phillips. Ziqamo actively participated in activities in the renewable energy laboratory and assisted with engineering awareness workshops in the rural areas of the Eastern Cape.

Sustainability and innovation in all its forms is the heartbeat of the faculty and the 2021/2022 period presented many opportunities to reimagine and expand our future post COVID-19.

With the support of the AMTC, the merSETA Autonomous Operations project contributed to the establishment of the Marine Robotics Unit (MRU), which is supporting key ocean sciences research, notably in collaboration with the South African Research Chairs Initiative (SARChI) in Ocean Science and Marine Food Security, headed by Professor Mike Roberts.

The MRU received additional funding support through the South African International Maritime Institute (SAIMI) for the establishment of a Marine Robotics Centre. Collaboration with Montpellier University in France has led to a postdoctoral secondment from Montpellier University to Nelson Mandela University in 2022 and the securing of funding for a study of the Antarctic ice with the University of Cape Town.

After three years of intensive audits and documentation submissions, in August 2022 Nelson Mandela University became the first university in South Africa to be issued with a Remotely Piloted Aircraft Systems Operating Certificate from the South African Civil Aviation Authority. The certification process was undertaken by the MandelaUni Autonomous Operations group (MAO) – a research group within the AMTC. This achievement allows the University to serve as a centralised access point for all drone operations and to offer its researchers, students and employees the opportunity to gain specialist skills, undertake unique research and operate in a wide range of fields, which include combatting marine poaching and forestry and fire control.



“ ... changemakers at the Centre for Community Technologies (CCT) promote the radical development of the human potential ... through the use of technology.”

During April/May 2022, AMTC MAO staff members, Damian Mooney and Jan de Jongh travelled to Reunion Island on the vessel Marion Dufresne as part of research collaboration with Nelson Mandela University's SARChI Chair in Marine Spatial Planning, Professor Mandy Lombard, and a number of French scientists.

MAO was asked to assist with drone operations from the vessel, by flying the drones out to whales that were in close proximity (2km) to the ship. The drones had to fly through and capture the spray being expelled through the whales' blowholes. Scientists analyse these samples to conduct research on the health of the whales. The MAO team designed and manufactured a purpose made rotary drone, named 'Snotbot' and a tethered kite system to fulfil their role.

In May 2022, our internationally renowned engineering innovation hub, eNtsa, turned 20. Its director, Professor Danie Hattingh, had the vision to launch it and together with his team he has continuously reimagined it. From a team of four, 20 years ago, today eNtsa has a team of 70, including engineers, scientists, physicists, office professionals, research associates and students, all busy with local and international research to support the broader manufacturing sector and advance technologies into the future, with a focus on the automotive, power generation and petrochemical industries.

In the field of information technology, Professor Darelle van Greunen and her team of changemakers at the Centre for Community Technologies (CCT) promote the radical development of the human potential in particularly disadvantaged communities through the use of technology. During 2022, Prof van Greunen received the Public Engagement with Research Award from the National Research Foundation, in recognition of the exemplary work she and her team conduct within the CCT. Prof van Greunen also received the Nelson Mandela University Engagement Excellence Award 2021.

The team in the Centre for Research in Information and Cyber Security (CRICS) published nine journal papers and one conference paper during 2021. Professor Kerry-Lynn Thomson

received an NRF C2 rating and was also elected as Vice-Chair of SIGCyber, a special interest group of the Institute of IT Professionals South Africa dealing with cyber security. She is joined on the committee by CRICS Professor Lynn Futcher.

The significant uptake of online platforms during the pandemic prompted the Director of CRICS, Professor Reinhardt Botha, and Honorary Professor Steve Furnell from the Network Research Group, Plymouth, England, to research matters of security and privacy in online meetings. The research considered challenges and possible solutions in this context and was published in May 2021 in the *Journal of Network Security*, in an article titled 'Facing up to security and privacy in online meetings'.

The core focus of research at the faculty's Built Environment Research Centre (BERC) is the sustainability of the built environment, with an emphasis on sustainable human settlements.

The Chair for Human Settlements at Nelson Mandela University, Professor Sijekula Mbanga, in partnership with the Technology and Innovation Agency and the Department of Science and Innovation, hosted a round table discussion under the theme 'Potentiality of Science, Technologies and Innovations for Sustainable Human Settlements in South Africa' in August 2021. The discussions included: the ethnography of technologies in human settlements; the impact of COVID-19 on human settlements; and the use of building information modelling in human settlements.

Academics have presented at several key conferences, professional body webinars and industry association events to engage publicly on the many aspects of sustainable human settlements, to communicate the science behind the research and how we can create a cleaner, greener, more human-centred built environment. Some of these events include the CM50 (Construction Management) Conference, Chartered Institute of Building webinars, Association of Construction Health and Safety Practitioners and other industry liaison events organised, among others, by the Master Builders Association.

In closing, I want to highlight an exciting development: the signing in July 2021 of memorandum of understanding (MoU) between Nelson Mandela University and the Automotive Industrial Development Centre Eastern Cape. This MoU has been operationalised in the form of a service level agreement, structured around three projects funded over a period of three years. The first of these is to re-establish the Chair in Automotive Engineering in order to facilitate increased innovation and international competitiveness of the integrated Motor Manufacturing Industry in the Eastern Cape.

The other two projects focus on material testing analysis (within eNtsa) and skills development and training for the automotive sector, aligned to global developments in electric vehicles, done in collaboration with the uYilo eMobility Programme in the faculty. An initiative of the Technology Innovation Agency (TIA), uYilo enables, facilitates and mobilises electric vehicle mobility in South Africa.

# Message from the Executive Dean of the **Faculty of Health Sciences** Professor Zukiswa Zingela

I stepped into the role of Executive Dean of Faculty of Health Sciences during the COVID-19 pandemic. Digitalisation was an essential component of faculty agility and responsiveness to the pandemic.

**W**e had to carry out as many learning, teaching and research activities online as possible, while closely consulting with our research and ethics bodies to make sure we did not breach any ethical boundaries and stayed true to the science. We also had to factor in costs for personal protective equipment over and above other projected research costs, given that several of our research projects are based on in-person engagement.

One is our *KaziBantu* project in the Department of Human Movement Science, which is designed to improve the health of school children and teachers through physical activity. Aligned to this, our Human Nutrition and Dietetics Department is drawing on their research to enhance the nutritional knowledge of school children and community members.

Food insecurity exacerbates the risk of non-communicable diseases such as hypertension, due to the associated poor diet and low vegetable intake. Part of our research aims to empower communities to bring back lost knowledge about indigenous vegetables, which are highly nutritious and better adapted to withstand climate change and water scarcity.

We are on a trajectory to grow postgraduate numbers and transdisciplinary research outputs across all our health disciplines. A re-curriculation process, guided by the Nursing Council's framework, has required putting some of the postgraduate programmes through the accreditation process. This will enable regrowth of the postgraduate programme capability in the Department of Nursing. In the Department of Psychology, we are focusing on strategies to enable an increase in the number of trans-professional and transdisciplinary master's and PhD supervisors.

The Medical School brings with it an advantage to further increase postgraduate programmes through the Master of Medicine (MMed) in various disciplines. Starting with two initially, we have initiated the process of institutional approval for a MMed in Psychiatry and a MMed in Paediatrics. These will then serve as templates to iron out any issues in preparation for additional MMed programmes.

While a formal Department of Psychiatry is not yet up and running, as a specialist in psychiatry, I am conducting research



and related work through my office. This includes work based on interventions to support healthcare workers during the pandemic. An example is the psychological preparedness skills training to equip healthcare workers with self-help skills to manage their anxiety and distress around COVID-19. I led a paper on this intervention published in the *South African Journal of Psychiatry* in March 2022.

The work has since been adapted into the development of a short learning programme (SLP) on enhanced preparedness training, with a focus on strengthening coping skills to meet challenges across different spheres of life. While the SLP is currently being put through the institutional approval processes, it is being offered to all who express a need within the faculty. Once it has been approved, we will offer it to other faculties and external entities. Additional facilitators include the Director of the School of Behavioural and Lifestyle Sciences, Professor Zoleka Soji, who is a clinical social worker, and Dr Phumeza Kota Nyati, Dean of Learning and Teaching, who is a psychologist.

Other mental health projects include 'MindKind' – a youth mental health research project. The research is sponsored by the Wellcome Trust, and includes other institutions like Higher Health, Walter Sisulu University, Oxford University, Washington University, as well as SAGE in the US. This project used a qualitative and quantitative approach to collect data from youth in South Africa, UK and India, the aim of which was to get the youth voice on data governance in mental health research. This allowed the participants to indicate their preferences in terms of storage of their data – server or cloud – and sharing of their data, including across country borders. The results are now out and there will be several publications over the next few months.

“Part of our research aims to empower communities to bring back lost knowledge about indigenous vegetables, which are highly nutritious and better adapted to withstand climate change and water scarcity.”

“The Medical School brings with it an advantage to further increase postgraduate programmes through the Master of Medicine (MMed) in various disciplines. Starting with two initially, we have initiated the process of institutional approval for a MMed in Psychiatry and a MMed in Paediatrics.”

A new addition to our faculty is the DSI-Mandela Nanomedicine Platform, a research chair in nanomedicine launched in 2021 as part of the Medical School. The Chair is held by Dr Steven Mufamadi, a leader in nanomedicine, who has developed a transdisciplinary platform for master's and PhD students from different disciplines, including pharmacy, physiology, environmental health and medical laboratory science.

A new faculty-wide area of research and engagement is on the social and health challenges of ex-mineworkers in the Eastern Cape. Over the decades, many young men from the Eastern Cape went to work in mines in the different provinces. In consultation with the Ex-Miners Council and other key stakeholders we are busy with multiple engagements across the province and nationally to try and define the health needs of ex-miners.

Another important area of community engagement and practice involves the challenges associated with the seasonal initiation rituals. In collaboration with the House of Traditional Leaders, who are the guardians of the initiate programme, we will soon be sharing details of how we are collaborating to address the problem of initiate morbidity and mortality.

In all our research, the faculty is focused on growing our scientific body of knowledge while serving others, and on playing our part in achieving the Sustainable Development Goals by improving the health and wellness of our communities.

# Message from the Executive Dean of the **Faculty of Humanities** Professor Pamela Maseko

At a time when humanities disciplines are losing favour in the world, our faculty has taken the University's Vision 2030 on the revitalisation of the humanities as a guiding principle of our intellectual project. How does our research help us understand, interpret and resolve the challenges facing humanity, especially in our African context?

**T**he research themes around which we have produced outputs in the past year respond to this question. In addition, we understand that the re-enlivening of the humanities at this time in our history requires that we rethink the demographics of our faculty. Our focus will be on women and young talent in particular, pushing the academy to rethink issues of transformation in South African higher education, especially on knowledge creation. The Capacity Enhancement Programme we initiated in 2021, designed for early career academics, is in response to this.

Our research also recognises that the meaning and value of humanities disciplines lies in coexisting with other disciplines.

We are acutely aware that historically, knowledge creation in higher education not only marginalised women's contributions, but also relegated knowledge on women to the margins. Our research and lead researchers are bringing experience by African women to the centre in our research practices.

We value knowledge on Africa, and through the African lens. This is in response to the calls, within and outside of the academy, to challenge the power dynamics of knowledge creation and dissemination, and to start to conceptualise hypotheses on African episteme.

What also distinguishes our research is our institutional collaborations within the region and beyond, especially with our research theme on Women's Digital Archive and Gendered Histories. We have jointly hosted colloquia and research seminars for postgraduate students doing research on the theme from at least seven universities across the country.

In the 2021/22 period, research in the faculty centred on our six strategic research themes, and was driven by the principles above.

The **African Vernacular Archive and Heritage Studies** responds to the epistemicide in Africa. It seeks to create an archive by identifying, securing, curating and archiving literary and other resources for academic purpose. Faculty research in this area includes the identification of writings produced by early literates in African languages. The value of this archive is documenting and valuing intellectual contributions of African thinkers of the 19th and early 20th century. This research is





largely funded by the National Institute for the Humanities and Social Sciences.

The Schools of Governmental and Social Sciences (GSS) and Language, Media and Communication (LMC) lead it. The History Department in GSS, for example, draws precolonial themes from early isiXhosa writings in a manner that assists in imagining the past and constructing our understanding of the present and the future.

The LMC led a seminar series on "Language, Knowledge and Power", in which they probed the value of language not only as a modium of mediation verbal transactions, but also as a repository of society's experiences.

The **Women's Digital Archive and Gendered Histories** is led by the faculty's Centre for Women and Gender Studies (CWGS) and the SARChI Chair in African Feminist Imagination, held by Professor Pumla Gqola. The Chair was formally launched in 2021 and since then there have been a series of impressive collaborations with universities and other entities from home and beyond, characterised by intergenerational dialogue from different perspectives. One of the highlights in 2021 was a dialogue led by the former Executive Director of the United Nations Women, Dr Pumzile Mlambo-Ngcuka, Ambassador Thenjiswa Mtintso and Dr Bev Ditsie, an LGBTI activist and artist. The dialogue was a reflection on the 25 years of the Beijing Declaration. One of its outcomes will be the publication of a volume on African women's intellectual histories.

Our aim is to position our University as an archival site for the works of influential African *oonozala* – sources of life – such as Dr Brigalia Bam, Dr Phyllis Ntantala and other African women thought leaders who have been on the margins of key debates in the academy.

The theme on **Public Management, Governance and Leadership**, driven from the Raymond Mhlaba Centre, is in response to one of the University's strategic intentions: to be a university "in service of society". It seeks to respond to specific areas of public administration and leadership, particularly in the areas of governance, public administration and policy, and its goal is to link humanities research and teaching with pertinent societal programmes to advance democracy, social justice, and the public good. In the reporting period the Centre hosted internationally acclaimed scholars who addressed an audience of academics and external university community on topics such as, "Leadership and accountability", "Elections, democracy and ethical leadership", "Generational politics and student activism".

The **Arts and Entrepreneurship** thematic area is linked to the School of Visual and Performing Arts and focuses on providing students with skills and experiences needed to be successful in the creation and performance of art, as well as equipping them with entrepreneurial skills so that they are able to launch their careers as artists.

**Identity and Social Cohesion** is driven by the SARChI Chair in Identities and Social Cohesion in Africa (ISCIA) held by

Professor Andrea Hurst. The Chair is partnered with the Centre for Philosophy in Africa and has had a significant impact with respect to the advancement of transdisciplinary knowledge on this theme both in traditional and non-traditional forms. It seeks to contribute to the philosophical task of reimagining South African "identities in question" and placing this in the context of the question of how to foster social cohesion in practical ways.

The Chair, supported by faculty staff, postdocs and postgraduate students, continues to generate outputs that respond to this critical research theme.

**Ocean Cultures and Heritage** is led by Professor Rose Boswell, who heads the SARChI Chair in this area of research. As South Africa pursues its oceans economy development goals, it is essential that it includes social science-led research on human cultural and heritage contributions to ocean conservation and development. The Chair is growing its national and global partnerships to research and document ocean cultures and

"Our aim is to position our university as an archival site for the works of influential African *oonozala* – sources of life ... "

heritage in South Africa, Mozambique, Tanzania, Kenya and Namibia. Several postgraduate and postdoctoral researchers are exploring different aspects of ocean culture and heritage and the necessity of including this dimension in ocean management. The Chair is characteristically diverse in its partnerships, and collaborates with researchers from Namibia, Kenya Mozambique and Mauritius among others. It also collaborates with staff in the faculty and boasts equally diverse postdocs and postgraduate students, continuing to generate cutting edge and transdisciplinary outputs.

The research themes above seek to position Nelson Mandela University as a university of choice for the study of the humanities and social sciences, both within and outside of the continent. They are intended to re-enliven the study of these subject fields by making them relevant and impactful, especially in understanding and improving the human experience. They also respond to a number of the UN Sustainable Development Goals, specifically on Gender Equality, Reduced Inequalities, Sustainable Cities and Communities, Life Below Water, Peace, Justice and Strong Institutions, and Partnerships for the Goals.

I wish to congratulate our students, researchers and collaborators for a successful year's work in 2021.

# Message from the Acting Executive Dean of the **Faculty of Law**

**Dr Lynn Biggs**

The Faculty of Law and Nelson Mandela University bid a fond farewell to Professor Avinash Govindjee, who was appointed as an acting judge for 2021 and as a permanent judge of the High Court of the Eastern Cape in Makhanda from January 2022. Dr Biggs has been Acting Executive Dean since 1 January 2021.

In the 2021/22 academic period, the Faculty of Law contributed solutions for sustainable development in a number of areas. The work of the SARCHI Chair in the Law of the Sea and Development in Africa, FishFORCE, the Refugee Rights Centre and the Labour and Social Security Law Unit (LSSLU) included: partnerships in sustainable ocean governance, training programmes to enhance the skills of persons empowered to protect marine living resources (including magistrates), the protection of refugee and migrant rights, and labour law and social security advice for community members.

Several faculty research areas significantly contributed to Nelson Mandela University's achievements in the 2020 and 2021 Times Higher Education Impact Rankings, with its strongest area of contribution being to Sustainable Development Goal 14: Life Below Water.

The SARCHI Chair in the Law of the Sea and Development in Africa, headed by Professor Patrick Vrancken, initiated and supported transdisciplinary and international collaborations on principles for transformative and sustainable ocean governance, and taught and supervised the first cohort of LLM Ocean Governance students. Individual research included the legal aspects of ocean renewable energy, noise pollution, marine spatial planning, labour law protection of fishers and maritime security challenges.

In November 2021, Prof Vrancken's SARCHI Chair and the Department of Public Law hosted "Beyond the Crisis: Challenges and Opportunities for Law and Development", the 5th Annual International Conference of the Law and Development Research Network. A significant conference, it was originally intended to be in person, but had to be moved online because of the pandemic restrictions. Fortunately, we were still able to host it successfully on the Zoom platform with simulated conference tables and breakout rooms, where delegates were able to engage as if they were at a live conference. More than 200 scholars of law and development (predominantly from the Global South) participated in the conference, with a focus on legal solutions to address poverty and inequality, as well as climate change, specifically from a Global South and developing world perspective.



“The SARChI Chair in the Law of the Sea and Development in Africa, headed by Professor Patrick Vrancken, initiated and supported transdisciplinary and international collaborations on principles for transformative and sustainable ocean governance, and taught and supervised the first cohort of LLM Ocean Governance students.”

Issues of social justice were prominent in the faculty's work during this period. In 2021, Professor Joanna Botha, HoD of the Department of Public Law, participated in the 11th session of the UN's Ad Hoc Committee on the Elaboration of Complementary Standards to the International Convention on the Elimination of All Forms of Racial Discrimination by presenting the report of the intersessional legal expert consultation. Prof Botha was asked to assist with the development of standards for regulating hate speech as a criminal offence and how states should work to promote the advancement of equality in domestic laws and policies. Another issue to be

addressed was whether the prohibition of racial discrimination should be extended to include religious discrimination.

The Department of Private Law was also responsible for hosting a successful online conference: the annual Private Law and Social Justice Conference, held in August 2021. Participants attended from throughout South Africa, as well as from Canada, Australia and Italy. The conference theme was “Beyond the Illusion of Social Justice” and 28 papers were presented by speakers from 16 universities.

At the August 2022 Private Law and Social Justice Conference, Professor Joanna Botha and Professor André Mukheibir presented a joint paper, “Combating gender-based violence through the private law of delict: developing a new standard for police liability”.

Thanks to the tireless effort of Professor Adriaan van der Walt and his team, March 2022 saw the faculty's in-house law journal, *Obiter*, being published online for the first time ([obiter.mandela.ac.za](http://obiter.mandela.ac.za)), enhancing the reach and accessibility of the journal.

The development of digital capacity by the University has served us well in many regards, in that several of our postgraduates are international students and we were able to present all of our master's coursework programmes virtually during the pandemic. This has placed us in good stead to continue this approach in future., providing broader access to our postgraduate programmes.

We also plan to introduce new electives in local government law and advanced public law in our LLM (General) course work programme.

Our postgraduate associate (PgAs) programme has seen an improved success rate of master's students and we currently have 15 who are registered for master's studies. We continue to support our academic staff members to get their doctorates by providing teacher relief funding. Of our 40 academic staff members, more than 50% either have or are working towards their doctorates.

Staff member, Dr Marc Welgemoed in the Department of Criminal and Procedural Law, received his doctorate at the December 2022 graduation, and five staff members are currently registered for the doctoral programme; three are aiming to submit their theses at the end of 2022 or early 2023.

We have hosted a number of case note writing retreats, with an emphasis on co-authoring papers and the aim of enhancing published research outputs. We also have a research hub run by Prof Patrick Vrancken and Prof Joanna Botha, held every second Friday to provide crucial research support to all postgraduate candidates.

In closing, it's good to be back on campus after the lifting of the pandemic restrictions; the majority of our staff are back and from 2023 all our students will have returned and will benefit from the enhanced combination of face-to-face and online interaction.

# Message from the Executive Dean of the **Faculty of Science** Professor Azwinndini Muronga

As we emerge from the pandemic, we have learnt valuable lessons in terms of being ready to do revolutionary research in the face of harsh realities. Our scientific predecessors led the way, such as Isaac Newton, who did his most revolutionary research during the bubonic plague of 1665/66, including his discovery that white light actually consists of a spectrum of colours.

**W**ith great pride I can say that the Faculty of Science has led the way for the University in producing 52% of all research output for the period, including 244 articles and 10 book chapters. We have also been very productive in terms of postgraduate numbers, with 54 master's students graduating in 2021 and 35 in the April 2022 graduation. We had 22 doctoral students graduating in 2021 and 19 in the April 2022 graduation.

At the end of 2022 and in early 2023, it will be important for us to review how productive the Faculty of Science has been during the pandemic.

Everything we do as a faculty needs to be forward-thinking for our researchers and graduates to thrive in the 21st century and the Fourth and Fifth Industrial Revolutions, or Society 4.0 and 5.0, which bring with them a fleet of new challenges, opportunities and careers.

As part of this, it is in the best interests of the faculty, University and country that we are contributing to the big science, transdisciplinary research landscape, including the SKA, MeerKAT and HIRAX (the Hydrogen Intensity and Real-time Analysis eXperiment). In 2021, our Centre for Broadband Communication was invited to join as a full member of the HIRAX project.

Digitalisation is essential to the faculty's growth trajectory and it is in the process of digitalising all its spaces as part of the university-wide digitalisation strategy. The pandemic highlighted the importance of e-research and e-research infrastructure to enable us to continue with our research wherever we are.

In the 2021/22 period, digitalisation facilitated an increase in international research engagements, partnerships and research outputs. The utilisation of technology to research internationally and attend international conferences without the cost in time and travel has been to our great advantage, with an increase in the number of conferences we hosted and attended, and an increase in research outputs. I, for one, produced more



scientific articles and attended more conferences during the pandemic than at any other time.

In July 2022, the faculty, through the Department of Physics, hosted the annual conference of the South African Institute of Physics. The conference highlighted issues of sustainable development and was attended by South African and international physicists and scientists. There will be a wealth of papers from this.

In order to pursue our transdisciplinary research trajectory, we need to foreground and strengthen the basic sciences and the foundation of the disciplines, and I want to reiterate the need for the University to support the protection and growth of the basic sciences in the best interests of the institution and society for a sustainable future. If we neglect the basic sciences nationally and internationally, the pursuit of sustainability will not be achieved.

In keeping with this worldwide priority, the year 2022 was designated by the international community as the International Year of Basic Sciences for Sustainable Development (IYBSSD).

To celebrate the IYBSSD, in 2022 the Faculty of Science participated in a suite of activities, including the centenary of the International Union of Pure and Applied Physics, of which South Africa is one of the 13 founding members. In November 2022 we are hosting the African School of Fundamental Physics and Application when over 100 postgraduate students from all over Africa, including South Africa, will meet at Nelson Mandela University. And in September 2023 we will be hosting the continental African Conference on Physics (ACP2022). All of these celebrate and address the Sustainable Development Goals (SDGs).

Sustainability and sustainable development is in the DNA and strategic focus of the Faculty of Science. It speaks of being in service to society, as expressed through our vision and mission.

**Our Vision is:** To be a world-class, engaged and transdisciplinary African Faculty of Science that responds to socio-economic and environmental challenges in society.

**Our Mission is:** To offer a diverse range of life-changing pure and applied science-based learning, teaching, research, training, innovation, engagement and transformational experiences, which develop excellent graduate and staff attributes for sustainable futures.

Nelson Mandela University ranked very high in terms of the SDGs in the 2021 and 2022 Times Higher Education (THE) Impact Rankings, with the Faculty of Science playing a leading role. In 2021 the strongest ranking was Life Below Water – 40th globally – and we were the only university in South Africa to rank in this SDG. For partnerships, we ranked highest in South Africa, together with the University of Cape Town and the University of Pretoria.

In 2022, our second year of participation in the THE Impact Rankings, our best performance was again in SDG 14: Life

“The faculty is committed to addressing the sustainability challenges facing our country, continent and planet ... ”

Below Water. With a score of 73.7 out of 100, Nelson Mandela University achieved a worldwide ranking of 69th out of 452 participating institutions and was ranked first in South Africa for this SDG. In addition, the University was ranked second in South Africa for SDG 13: Climate Action and SDG 15: Life on Land.

The faculty is committed to addressing the sustainability challenges facing our country, continent and planet (the ‘pale blue dot’ – our only known home), and to ensure that the subjects and research areas we offer are focused on new knowledge and innovation for a better world for all. This is driven by a solid foundation in the basic sciences, namely zoology, environmental sciences, agriculture, biological sciences, earth sciences and medical and health sciences.

In the faculty's new structure, these research areas are included in the Life, Earth, Environmental and Agricultural Sciences (LEEAS) cluster, which is all about sustainability. New niche areas include atmospheric and oceanographic sciences, resource security and energy solutions. The faculty has created an ‘X-Stream cluster’ under which science and technology in society, science communication and smart connected society, are recognised as new directions.

The X-Stream cluster establishes research experience for undergraduates and advances postgraduate research. It also proactively develops the faculty brand and expands and advances partnerships with local, national, African and international stakeholders to strengthen the faculty's footprint, and it embeds cultural, socio-economic and environmental stewardship as a faculty culture and practice.

This is all part of the drive by the faculty and the University to position itself as a higher education leader in Sustainability Sciences. The basis for this orientation is that the current injudicious use of natural resources is unsustainable. We are compelled to take a different look at ourselves and our planet and how to sustainably manage all life here.

# Nanomedicine Chair Working on Life-Changing Innovations

In 2021 the DSI-Mandela Nanomedicine Platform, a new research chair in nanomedicine, was launched in the Faculty of Health Sciences as part of the Nelson Mandela Medical School.

“My aim is to create a platform to significantly advance nanotechnology in South Africa. I’m obsessed with nano and over the years I’ve developed strong local and international networks from which to develop partnerships that can work on life-changing innovations,” says Dr Steven Mufamadi, who was appointed to the Chair in October 2021.

Dr Mufamadi has served as a consultant for universities, government departments, regulatory authorities and pharmaceutical companies, locally and internationally. He is the founder and managing director of his nanomedicine consulting company, Nabio Consulting (Pty) Ltd.

At Nelson Mandela University, Dr Mufamadi’s first major task was to build a nanomedicine laboratory from scratch. Completed in August 2022, the laboratory is located on the Medical School’s Missionvale Campus. Here Dr Mufamadi has developed a transdisciplinary platform for master’s and PhD students from different disciplines, including pharmacy, physiology, environmental health and medical laboratory science. He also established an elective course in pharmaceutical nanotechnology for final year students in the Department of Pharmacy.

Initial research areas of the Chair include:

### Environmental health project air purifier (robotics)

“We want to create a robot that moves around and cleans the environment by sucking in polluted air, including air polluted with TB and other harmful bacteria and viruses, such as COVID-19,” Dr Mufamadi explains. The robot works like a vacuum cleaner, with active antiviral nanomaterials in the membranes of its filter that immediately kill the virus. “The filter will be ready in about six months and once we see that the membranes are working, we’ll work with engineers to design the robot. Panasonic South Africa is interested in working with us on this,” says Dr Mufamadi.

### Blood transfusion project

The South African National Blood Service faces a major problem of never having enough blood or a supply of a particular blood group at the time of need. In addition, blood needs to be stored in a fridge, which is impractical for many parts of South Africa.

“We’re working with green nanoparticles that use plant extract such as Cannabis sativa and microalgae as a reducing agent, both of which have many disease-fighting phytochemicals/ biomolecules.”

Hemopure®, a blood substitute that comes in powder form into which sterile water is added to create blood, has already been approved for use in South Africa for the treatment of acute surgical anaemia.

“One of our senior researchers is putting together a proposal to try and take this a step further by incorporating nanomaterials for added benefits, including blood that doesn’t need a blood group, that can be stored at normal room temperature and that is easy to use in ambulances and remote areas,” Dr Mufamadi explains.

“We aim to have a prototype ready within a year. We’ll use a microfluidic lab-on-a-chip technology and 3D printer to reproduce the artificial blood – I learnt this skill while working at Novartis in Switzerland.”

**Nanomedicine**  
Nanomedicine uses materials at the nano scale in a number of health care applications. The nano scale is too small to be seen with a regular lab microscope. A nanometre equals one-billionth of a metre. That’s thousands of times smaller than the diameter of a human hair.



### Breast cancer

Breast cancer is the most frequent cause of cancer death in South Africa. According to the 2014 National Cancer Registry, one in 27 women in South Africa is at a risk of developing breast cancer. Triple negative breast cancer (TNBC) is the most aggressive form.

Dr Mufamadi says: “We are working on a drug delivery system where we use nanoliposomes, lipid nanoparticles containing chemotherapy and/or plant-sourced ‘green’ nanoparticles to develop a personalised nanomedicine for TNBC patients.

“We are also working on disease detection and diagnosis to develop a nano-biosensor for fast and accurate diagnosis of TNBC. Mintek has already designed this but we’re taking a different approach.

“We’re working with green nanoparticles that use plant extract such as *Cannabis sativa* and microalgae as a reducing agent, both of which have many disease-fighting phytochemicals/biomolecules. We’re partnering with InnoVenton (the Institute for Chemical Technology) at Nelson Mandela University on this as they specialise in microalgae. We engineer the green/microalgae nanoparticles to look like a microorganism (e.g. a bacteria or a virus) that then seeks out where the virus is hiding

“My aim is to create a platform to significantly advance nanotechnology in South Africa.”

in the body and targets it, either ripping it apart or blocking its growth.”

### Diabetic foot ulcers

Patients with diabetes often suffer from foot ulcers, which are slow to heal and can lead to further complications, sometimes resulting in limb amputation or even death. Researchers in the Chair are working to come up with a nanocomposite hydrogel that can be impregnated with green nanoparticles and/or drug-loaded nanoparticles. This would be used in biodegradable topical applications, such a sock, bandage or insole, thus improving the delivery and efficacy of wound-healing and antibacterial medication to the affected site.

# South Africa's First Marine Spatial Plan is for Algoa Bay

South Africa's first Marine Spatial Plan (MSP) is for Algoa Bay. It will be ready before the end of 2022, put together by a transdisciplinary team in the Institute for Coastal and Marine Research (CMR).

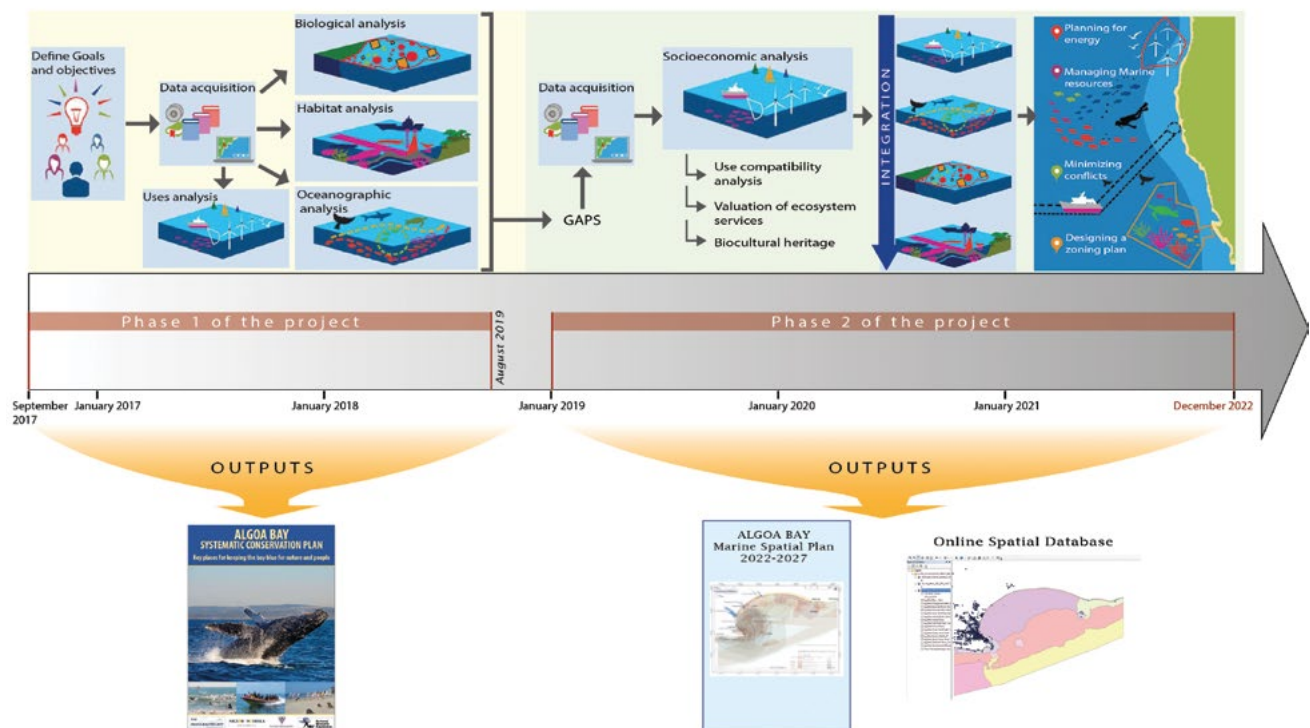
"As scientists committed to sustainability we are developing a Marine Spatial Plan, which is essentially a layered map that can accommodate the many role players in the marine environment," says Dr Anne Lemahieu, a postdoctoral researcher in the CMR specialising in coastal geography. She collaborates with postdoctoral social scientist Dr Nina Rivers; both are part of the SARChI Chair in Marine Spatial Planning (MSP) situated in the CMR, and held by Professor Mandy Lombard.

Among those to be accommodated in the Marine Spatial Plan are commercial and small-scale fisheries, shipping, tourism, Marine Protected Areas, wildlife, ecosystem services, the navy and industries, such as the energy industry. Economic development has to be done without compromising the environment. This is non-negotiable because the ecosystem services the oceans deliver are essential for our survival.

The MSP Act was gazetted in 2021. "Algoa Bay was selected as South Africa's pilot site for a number of reasons, including that there has been long-term biophysical monitoring of the bay, it has two harbours, a deep-water port, marine tourism and the largest chokka/squid fishery in South Africa," Dr Rivers explains.

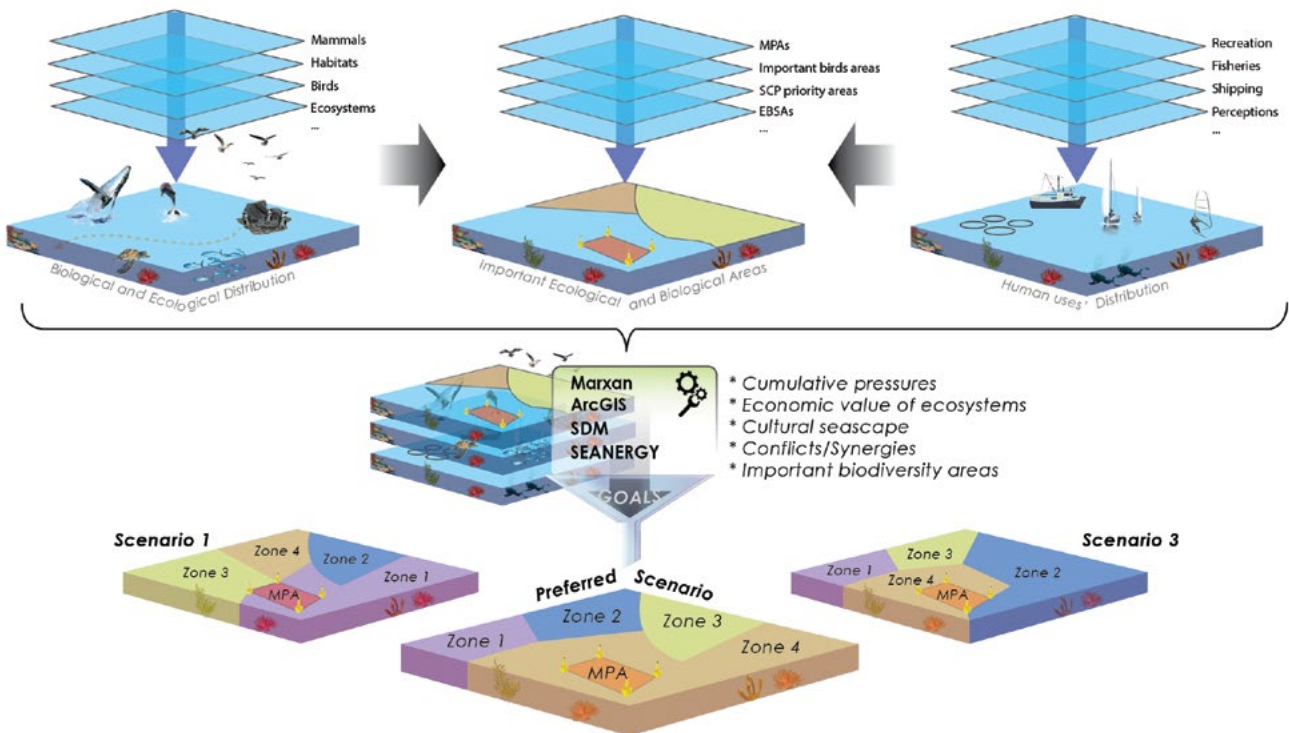
The researchers work closely with government, as the national MSP process is happening at the same time for the four marine areas along South Africa's coastline: western, southern, eastern and the Prince Edward Islands. Algoa Bay is in the southern marine area and its MSP is intended to inform the upscaling of the whole southern area.

"The aim of the Algoa Bay MSP is to allocate the different sectors to zones in a way that achieves ecological, economical and societal sustainability objectives," says Dr Lemahieu. "The goal is to establish a balance between economic, conservation,



Algoa Bay project timeline – two phases: a systematic conservation plan and a draft marine spatial plan





From data to zoning: spatial data for all the sectors in the bay are created and a soft-couple model (Marxan-SDM) is used to determine zoning

social and cultural requirements to accommodate the wide range of role players. At the same time we need to determine the economic value of the marine environment’s ecosystem services, such as oxygen, carbon sequestration, food and medicinal resources, so that we can justify to government why, for example, we need to conserve the marine environment where it is at risk.”

Marine Spatial Plans are essential because, as many coastal managers have pointed out, if there is no map or record of what an area accommodates, then it is treated as if it doesn’t exist. “To address this, in addition to creating layered maps for the zones and uses, we are taking photos and videos and interviewing people, right down to the personal level, such as how and where a fisher’s grandparents taught them to fish, and what the fish abundance was like when they started fishing,” says Dr Rivers. “We have made every effort to ensure the Algoa Bay MSP has pursued a truly public engagement process to be as inclusive as possible.”

Very few MSP projects integrate the tangible and intangible cultural knowledge in the marine layering, so this is pioneering work. The difficult part is to determine how much weight should be given to each layer.

“The aim of the Algoa Bay MSP is to allocate the different sectors to zones in a way that achieves ecological, economical and societal sustainability objectives.”



# Modelling a green and smart village in Ekuphumleni

Sustainability-oriented research for cities and settlements aims to forge new paths to solve complex societal problems that include the impact of climate change, poverty, inequality and urban pandemics. This research uses methods that promote co-creation and transfer of knowledge between the University, community organisations, industry and international partners.

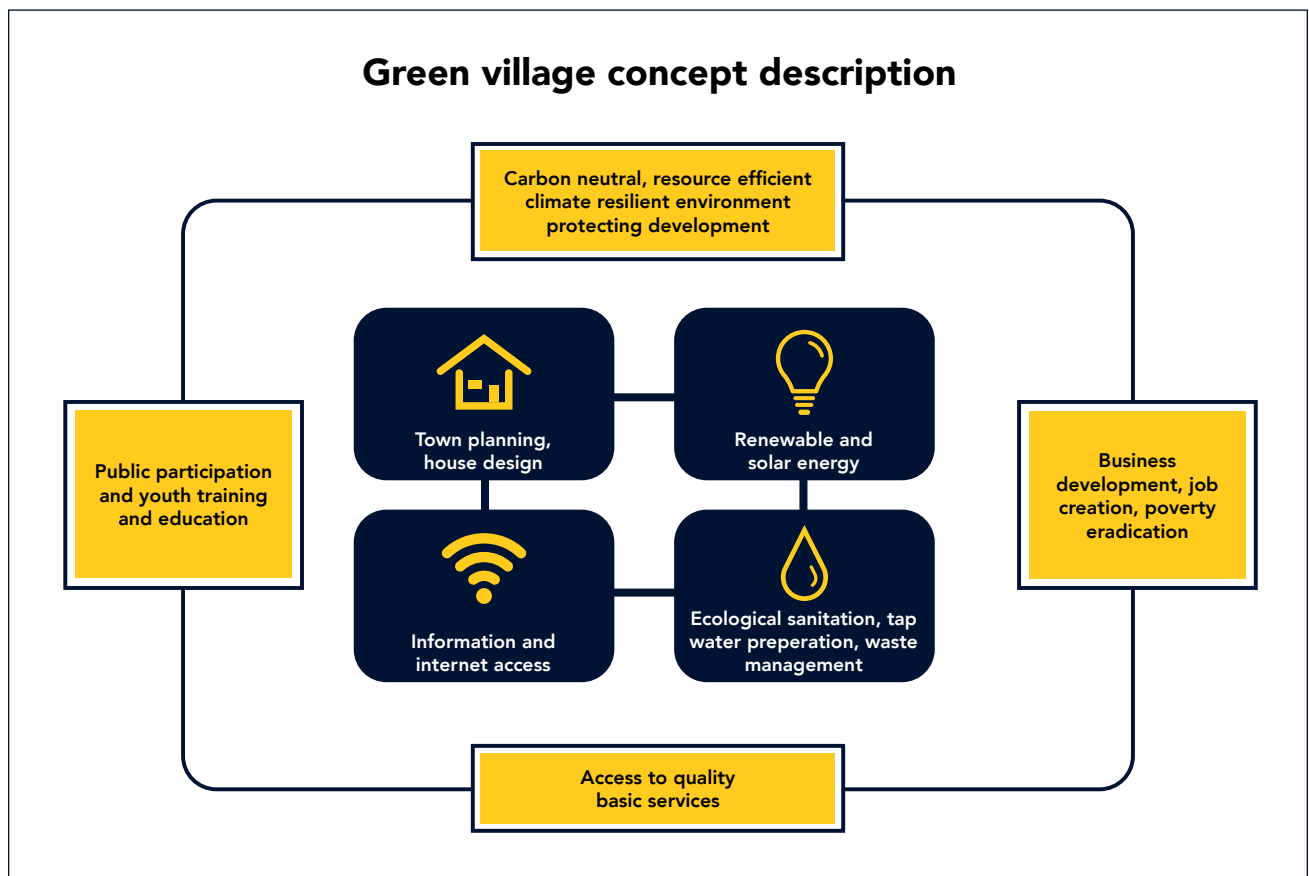
An example of this is the Ndlambe EcoSUN Green Village project in Ekuphumleni Township in Kenton-on-Sea, which is in the Ndlambe Municipality of the Eastern Cape. It is a typical innovative community engagement research project, pursued in a trans- and interdisciplinary manner and anchored to a strong multi-sector engagement framework that includes international cooperation.

The EcoSUN Green Village promotes science and technology transfer between South Africa and Germany, facilitated by Nelson Mandela University and Germany's University of Potsdam. The Germany Department of Education and Research, the South Africa Department of Science and Innovation, Eastern Cape Department of Human Settlements,

the National Home Builders Registration Council and the Council for Scientific and Industrial Research are co-operative participants.

The project tries to show how a climate change responsive settlement can be designed from scratch, using innovative technologies, multi-stakeholder participation, and streamlining internal and external funding sources to build sustainable communities in the Eastern Cape.

To do so, it applies innovative technologies for grey water recycling and renewable energy use, alternative sanitation solutions, organic waste management, green landscaping, ecologically sound stormwater management as well as education, job creation, and enterprise development and support.





It has also sought to introduce, in the medium term, a new Community Green Village Technician professional with research and curriculum development involving multiple stakeholders. These are the Berlin-Brandenburg Vocational Institute and Technical University of Berlin in Germany, the Port Elizabeth and East Cape Midlands TVET Colleges in South Africa, supported by European funding at Potsdam University, and implementation coordination by Nelson Mandela University and the Council for Scientific and Industrial Research.

### Defining a 'smart green village'

What is a Smart Green Village? And what are its development principles and outcomes?

Prof Sijekula Mbanga notes that green, and smart, village development is about:

- Natural places and spaces where people can live, work, and play
- Mainstreaming environmental issues in development programmes and projects
- Using natural resources without harming the natural environment
- Creating a win-win-win for the environment, economy and community

- Creating aesthetically beautiful living spaces (the built environment) where luxury and comfort fit into the natural landscapes, affecting each other in a positive and sustainable manner
- Integrating environmental sustainability principles, approaches and actions into development activities to achieve poverty reduction and economic transformation
- Raising awareness and training community members and beneficiaries to manage, own and sustain project benefits.

Smart Green Villages aim to achieve efficient, effective, equitable and sustainable use of natural resources through:

- Energy efficiency
- Water self-sufficiency
- Pollution reduction (increasing "fresh air")
- Sustainable solid waste management solutions
- Car-free zones (safe for the pedestrian, or using electric cars and e-hailing ride services)
- Sustainable land-use and agricultural practices
- Innovative materials and building systems
- Sustainable sanitation solutions.

In addition, they incorporate appropriate Information and Communication Technology (ICT) capabilities to benefit the local community.



**Green Village development outcomes**

One of the desired outcomes of the Ndlambe EcoSUN Green Village is that it should be sustainable and cost effective in its efficient use of energy.

It also should be user-friendly, and encourage technology transfer and uptake in infrastructure and social development. Principles of environmental and institutional management should be adhered to throughout.

**Development principles**

The key principles include but are not limited to conserving energy, water and other resources to preserve the environment, strengthen the local economy and promote the general well-being of citizens.

Developmental principles are transformational in character and demonstrational in evolution. They are also designed to be flexible, modular and scalable.

The idea is that they should be a catalyst for existing economic activities. Driven by strong community participation and acceptance, they should be appropriately aligned to the community’s specific needs.

**Project background**

Stakeholders defined criteria to select the site to pilot and implement the model, choosing the Ekuphumleni community in Ward 4 of Ndlambe Municipality. It was selected due to challenges that technologies could address, such as poor infrastructure, as well as water and electricity supply shortages.

The growth rate per annum was 2% from 2011 until 2018. Farmworkers moving to the towns for opportunities for work and a better life contributed to this growth, putting pressure on the municipality to provide services.

The town of Kenton-on-Sea is also a holiday destination and numbers in certain areas can increase ten-fold during the season. This puts additional pressure on electricity and water resources.

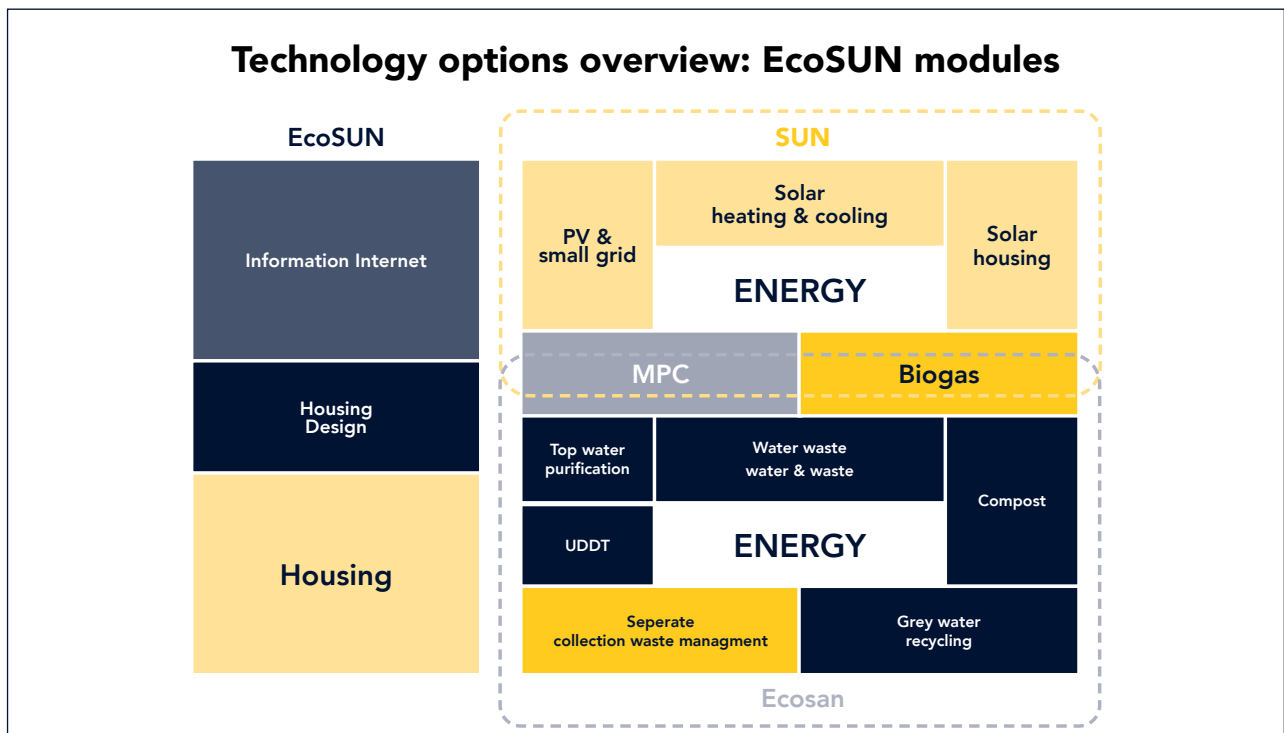
Kenton-on-Sea and Ekuphumleni settlements had a population of 5194 in 1879 households with an average household size of three (2.8). Residents contribute 8.5% towards the total living in the Ndlambe municipal area. One quarter (24.7%) of the population in Ward 4 are under the age of 15, 13.2% are older than 64 and the remaining 62.1% fall within the 15 to 64 age bracket. At least 8.2% of the inhabitants over 19 years of age in Ward 4 had not received any schooling and 31.6% completed or underwent some primary education. Further, 23.4% matriculated or received a higher learning degree.

This suggests that the ward has a mixed labour market, with a large component of elementary and semi-skilled workers. The municipality and sector departments therefore should promote labour-intensive development projects.

About 23.1% of the 5194 inhabitants are employed in the formal sector, 2.7% in the informal sector, 4.5% in private households, and the remaining 69.7% fell within the not-applicable category (pensioners and workers not active in the labour market).

Approximately 15.3% (287) of the 1879 dwellings in the ward did not receive any income and so, technically, one in every 6.5 households were impoverished. In addition, 37.1% of the population in Ward 4 did not receive a monthly income and a further 25.6% earned less than R801 a month, according to StatsSA 2011.

The project pilot site was therefore an ideal site to show how the EcoSUN Green Village model could be used to provide socio-economic benefits to the Ekuphumleni Community.



# Innovating at the International Forefront

In May 2022, Nelson Mandela University's internationally renowned engineering innovation hub, eNtσα, turned 20. Its director, Professor Danie Hattingh, had the vision to launch it and to continuously reimagine it.

“Twenty years ago there were just four us, and the big drive at that stage was high-end engineering support for the automotive industry to improve the quality of their products and export readiness,” says Prof Hattingh, who also had a research programme in solid state welding at the time.

Today, eNtσα has a team of 70, including engineers, scientists, physicists, office professionals, research associates and students, all busy with local and international research to support the broader manufacturing sector and advance technologies into the future, with a focus on the automotive, power generation and petrochemical industries.

Current research focuses on welding, structural integrity and life extension methodologies for petrochemical and coal-fired power plants. The institute has the most advanced facility to test and evaluate the creep, or deformation, properties of aged materials extracted from petrochemical and power plants. This

identifies critical areas to inform engineering decision makers and assists with prioritising areas in need of replacement, as well as the development of methodologies for safe extension of component life.

Prof Hattingh says: “Our work in this space has put us at the international forefront, as certain European countries are forced to start up old coal-fired power plants for the medium term, given the gas situation with Russia.” They have industry and technology partners in Germany, Finland and the UK. South African partners include Sasol and Eskom.

“In South Africa and internationally many of the power plants are close to or beyond their intended original design life,” says Prof Hattingh. “It is expensive to build a new coal-fired power plant, it takes time, and they are bad for the environment. If we can safely extend the life of power plants while developing and upscaling environmentally friendly solutions, it is a huge win.”



Ocean Glider team 2021



“We are intensifying our international network with industries and universities in Germany, the UK and Australia, in order to grow the international business.”

Another significant eNtsa research area is its uYilo eMobility Technology Programme. With the advent of electromobility – or e-mobility – considerable research is being conducted on batteries and battery technologies, as renewable energy storage is a major issue worldwide. uYilo is also preparing South Africa for e-mobility and assisting government in aligning efforts towards the shift. Postdoctoral researcher, Dr Brandon Davoren, joined eNtsa in 2022 to further its battery research initiative.

Marine robotics is also a focus area, helping scientists to gather data more efficiently and to obtain novel data from marine environments they haven’t been able to access before. The data-gathering technology goes hand in hand with the development of ocean gliders and marine satellite communication capability, all part of the research focus at Mandela University.

As part of eNtsa’s constant reimagination process, in 2020 it embarked on a five-year revitalisation programme to increase its international impact. “We are positioning ourselves as a world-class, commercially viable, engineering innovation and research organisation with a global footprint. We are certainly heading in the right direction to present ourselves as such,” says Prof Hattingh.



Prof Danie Hattingh



Battery Testing facility within the uYilo e-Mobility Programme

“We are intensifying our international network with industries and universities in Germany, the UK and Australia, in order to grow the international business. We are also embracing digitalisation in everything we do, including creating a highly visible profile on social and other media platforms.”

The five-year programme is aimed at increasing eNtsa’s revenue by 30% per year through internationally funded research and development contracts, which bring in a euro/dollar-based income. eNtsa has two income streams: self-generated funding and funding from government, mainly via the Technology Innovation Agency (TIA).

“In addition to these funding streams,” says Prof Hattingh, “we are in the process of establishing a commercial arm with the University to provide new services and to spin off innovations into private companies. A lot of the work we are currently doing is suitable for this.”



# Microalgae – Wonder Product for SA’s Bio-Economy

With a powerful biorefinery to process microalgae as a renewable, health-giving resource, InnoVenton/DCTS innovates and develops products for the energy, pharmaceutical, agriculture and food sectors.

Using biostimulants extracted from microalgae to boost agricultural plant growth and contribute to nanomedicine, is all part of the value chain at InnoVenton/DCTS (Institute for Chemical Technology and Downstream Chemicals Technology Station).

“From concept to the harvesting and formulation of microalgae for a range of products, InnoVenton/DCTS is focused on contributing to a vibrant bio-economy,” says InnoVenton Acting Director, Dr Gary Dugmore. “We have intentionally positioned ourselves to support the Department of Science and Innovation’s bio-economy strategy, with its emphasis on the industrial and environmental sectors, agriculture and health.”

At InnoVenton they have microalgae growing in ponds and buckets. It’s a rapid way of growing biomass that doesn’t take up much space, and, while it uses a lot of water to grow it, the water is repeatedly reused.

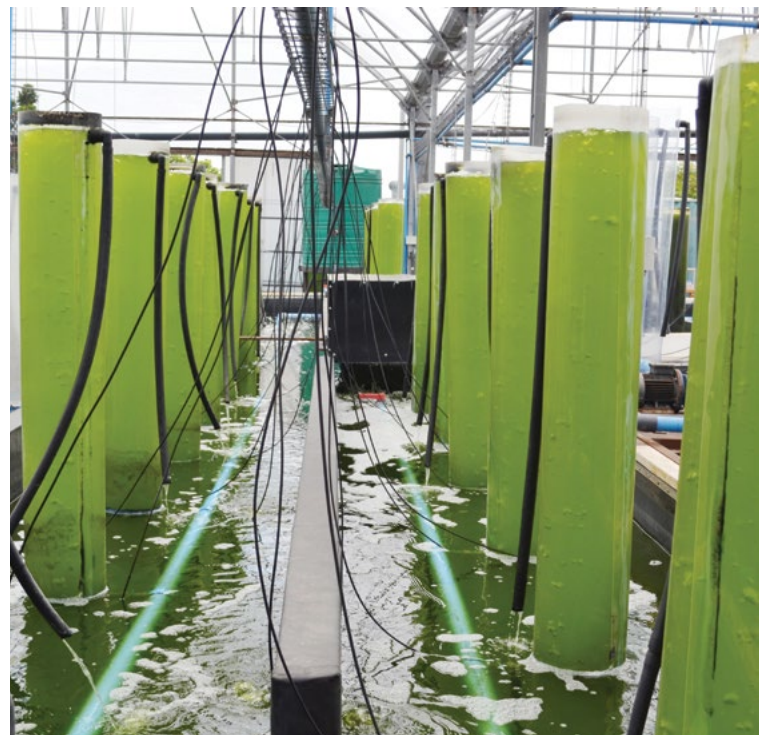
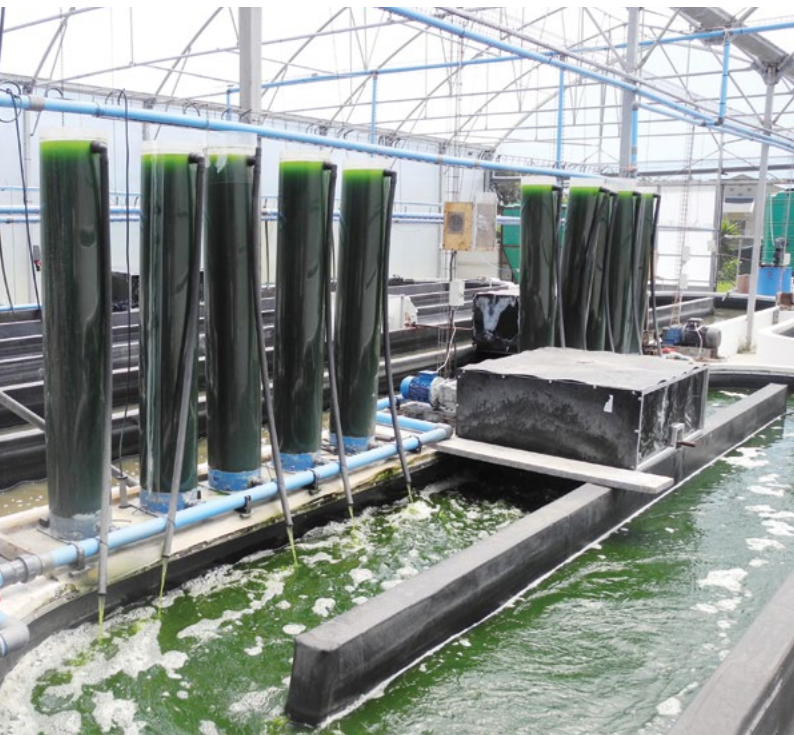
“In 2008 we first started using microalgae in our biorefinery to develop a recovered-waste fossil fuel product called

Coalgae®. Essentially, we mix algae slurry with fine waste coal and pass it through the filter process,” says InnoVenton’s technical manager, Louise Hamilton.

“Coalgae® is fully developed but the techno-economics of using it on a large scale are not there yet. We’re actively working on this, but in the meantime we are testing it with smaller businesses. Currently, for example, a chicken abattoir in Jansenville, Eastern Cape is using it as fuel for their 20-ton boiler.”

Innovation with microalgae is not new but it is currently enjoying considerable momentum worldwide. “It’s all about getting away from fossil fuel and non-renewable sources,” explains Dr Dugmore. “The CSIR, for example, used algae-based technology to make biodegradable plastic bags. We can use the carbon from algae rather than carbon from fossil fuels to contribute to South Africa’s bio-economy drive.”

The InnoVenton team has been working on developing higher-value products, using the biorefinery facility to get as much





“Microalgae are known for their antioxidant, immune-boosting and anti-inflammatory properties and high protein content ... ”

value as possible out of the microalgae, and increasing their collaborations with industry, small and large.

“Omnia Fertilizer is one of the larger companies we are working with to test our biostimulant product – a microalgal extract that stimulates growth in plants as a complement to fertiliser to increase crop yields,” says Hamilton. “In adverse conditions such as drought or poor soil, it helps the plants cope better and uptake nutrients more efficiently.”

Microalgae are known for their antioxidant, immune-boosting and anti-inflammatory properties and high protein content and are used as a beneficial food-grade ingredient, as well as for food colourants and cosmetics

One of several InnoVenton successes is a low-tech, cost effective, high yield spirulina cultivation system to produce biofertiliser and animal feed. For example, the microalgae formula has been developed to replace fishmeal in fish feed. This is currently being tested at a Gqeberha-based tilapia aquaculture project.

“We recently started working with Dr Steven Mufamadi, who holds the new Chair in Nanomedicine at Mandela University,” says Dr Dugmore. “We’re looking at the optimisation of a phycocyanin protein extraction from microalgae as an active ingredient and component in the formulation of nanomedicine. Dr Mufamadi is looking into the potential of microalgae applications for wound-healing in diabetes sufferers.”

To grow skills in all areas of the bio-economy, in April 2022 InnoVenton launched its one year transdisciplinary graduate internship programme, which includes graduates from Mandela University, University of Johannesburg, Walter Sisulu University and Durban University of Technology.







their prey. The research is conducted in collaboration with the University of Paris-Saclay, BirdLife South Africa and the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB).

“We’ve also placed larger hydrophones next to the penguin colonies to measure the sounds in the bay and next to the bunkering, as the operators claim their activities do not make much noise.” Prof Pichegru is also part of the Bunkering Environmental Working Group, established by the South African Maritime Safety Authority (SAMSA) in 2017 following the 2016 oil spill.

“We are working with the bunkering authorities, the Department of Forestry, Fisheries and the Environment (DFFE), SANParks, and a range of conservation organisations, including SANCCOB, Bayworld and WESSA, to better understand and minimise the risks of bunkering in our bay,” she explains. SAMSA published the first ever bunkering code in early 2022.

A further threat to the already fragile penguin populations is the level of competition for the fish stocks on which they depend for their diet. Local sardine fisheries target the waters around St Croix as it’s their closest source.

However, penguins can lay two eggs twice a year, so their population could possibly recover, but this would require substantial change with regard to their environment, including banning fishing close to the penguin colonies and reducing

bunkering activities. Prof Pichegru says: “We are currently in discussion with DFFE Minister, Barbara Creecy, as we are at serious risk of conservation measures being implemented too late to save the penguins.”

### Penguins and seismic blasting

In 2013 a seismic survey company exploring for oil and gas in Algoa Bay provided Prof Pichegru with funding to research the noise impact on the African penguins on St Croix before and after seismic surveys, which took place 100 km south-west of the island.

“Our research team’s findings were published in scientific reports in an article titled ‘Avoidance of seismic activities by penguins’ and we found that the penguins swam in the opposite direction from where they normally foraged when there was seismic activity,” says Prof Pichegru. “We deduced they were avoiding the noise. After the blasting they returned to their foraging grounds.

“The problem is that if the company had gone into production (it didn’t because it didn’t find adequate oil and gas resources), then there would have been constant noise in the bay, which would have permanently altered noise levels, adversely affecting the penguins.”





## CANSA pain manager app

As part of International Cancer Survivors’ Day on 1 June 2022, the CCT and the Cancer Association of South Africa (CANSA) launched a free CANSA Pain Manager app on Android, sponsored by Pfizer.

Prof van Greunen explains that COVID-19 resulted in a greater dependence on caregivers at home, due to limited access to medical staff and facilities. “The CANSA Pain Manager app was developed to assist the patient and caregiver in understanding pain better; locating pain; identifying intensity of pain; administration of medication correctly and timeously, as well as providing reports that can be exported to medical personnel or oncologists.”

### C-Vive app

Given the prevalence of cancer, the CCT’s mobile C-Vive app helps to increase the awareness of cancer with information on lifestyle changes, diet, exercise, cancer symptoms, cancer treatment and risks. It also has telephone numbers to call for assistance and support. The content is available in English and isiXhosa and contains audio and video clips.

### LEAP-Agri

To help farmers in Africa deal with the effects of climate change, CCT postgraduate students are developing an innovative tool for farmers to help them monitor soil and climate conditions in order to optimise their crops. The project is being funded by the National Research Foundation and is part of Leap-Agri, a joint Europe–Africa research and innovation initiative for food and nutrition security and sustainable agriculture. The easy-to-use sensor box is 3D-printed at Nelson Mandela University with the sensors built into the box. Sensor readings and testing were conducted in different parts of South Africa, Zimbabwe, Uganda and Kenya. In the field, the box can work without connectivity as it runs off a battery, and the farmer can take the readings off the sensor box screen and enter them into the app on their phone.



Apart from books, the library houses more than 300 000 local and 120 000 international research papers with digital access provided. This is how a library should function in the 21st century.

Another good example is Uganda, where public libraries are staffed by librarians with e-training skills. The libraries are attracting trainees from all walks of life and receiving new donations of computers and data packages to create places of access for the community at large. Kenya is creating a similar environment.

“South Africa is fortunate to have libraries in every city and town, but they are not being properly used or used at all,” says Prof van Greunen. “Our libraries should be vibrant Wi-Fi hubs for learners and students in every community and contribute to nurturing a culture of education by providing access to knowledge. Unsuitable material can be blocked.”

Digital access has certainly advanced in many of the schools in our urban areas, but the e-readiness movement is far too slow within the wider South African schooling context, and we need to be far more urgent and innovative in expediting this.

Since 2013, government has pledged to deliver free broadband access to 90% of South Africa by 2020 and 100% by 2030, through its SA Connect campaign. The goal of South Africa’s 2004 White Paper on e-Education was for every learner in the country to be ICT capable by 2013, and for teachers to use ICT to enhance teaching and learning. Neither has been achieved and this must urgently change.

“To assess and evaluate the e-readiness of all government schools in South Africa, our CCT team helped to develop an eReady ICT Maturity Assessment tool in the form of an easy-to-use app,” says Prof van Greunen. “In 2020, the app was rolled out to 8000 of South Africa’s 26 000 government schools to understand the level of intervention required to enable ICT-based education in government schools.

“This helped us to refine the app so that it can be rolled out to all 26 000 schools towards the end of this year. At the same time, the Department of Basic Education needs to make sure it has the budget to expedite the process, not only to assist the schools to become ICT ready, but also to train the educators. There is no point in having high-tech schools without trained teachers to support this.”

“Time is not on our side,” Prof van Greunen concludes. “For every year we do not achieve e-readiness in our schools, our learners, particularly in the rural and township areas, fall behind.”



# Record of life in **the Humble Pollen Grain**

Pollen is one of the most powerful tools for reconstructing environmental change because it is perfectly preserved in sediments for as long as plants have been on Earth.

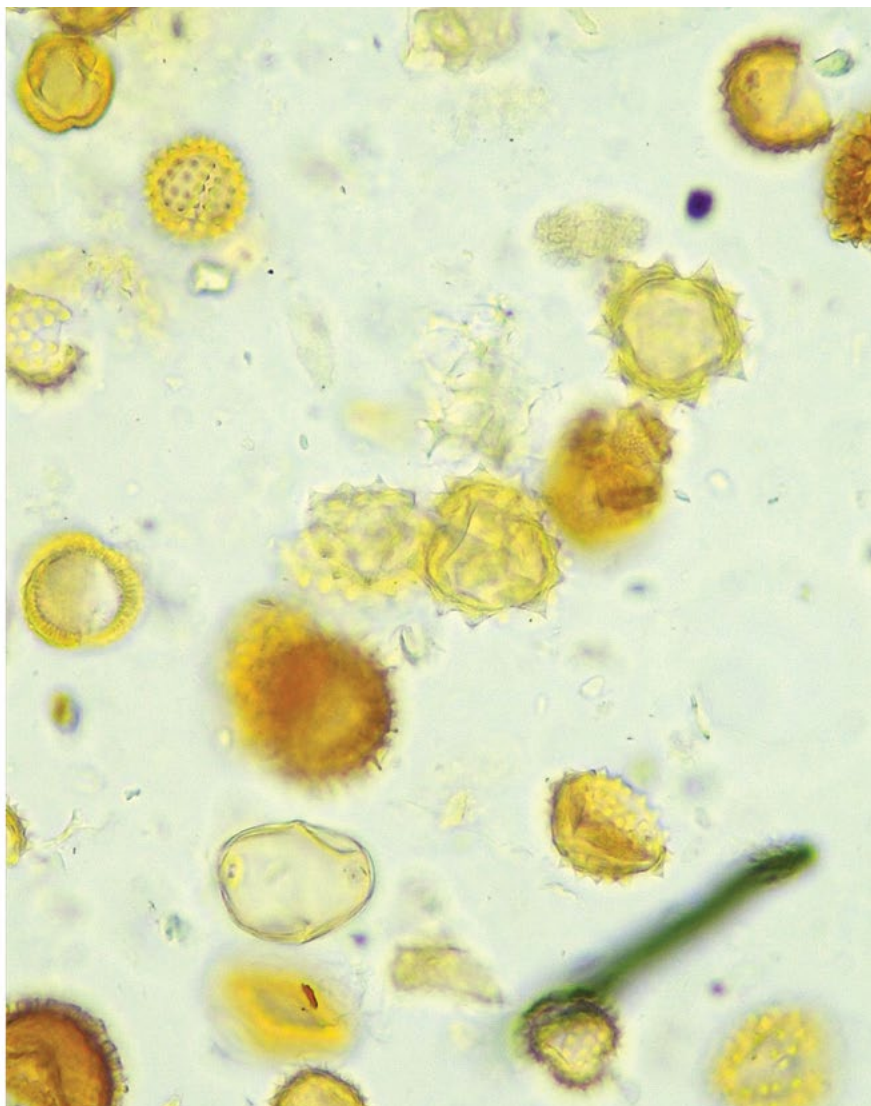
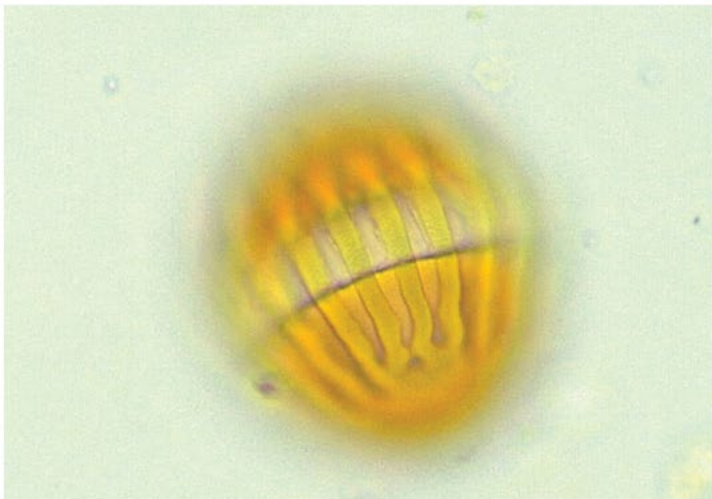
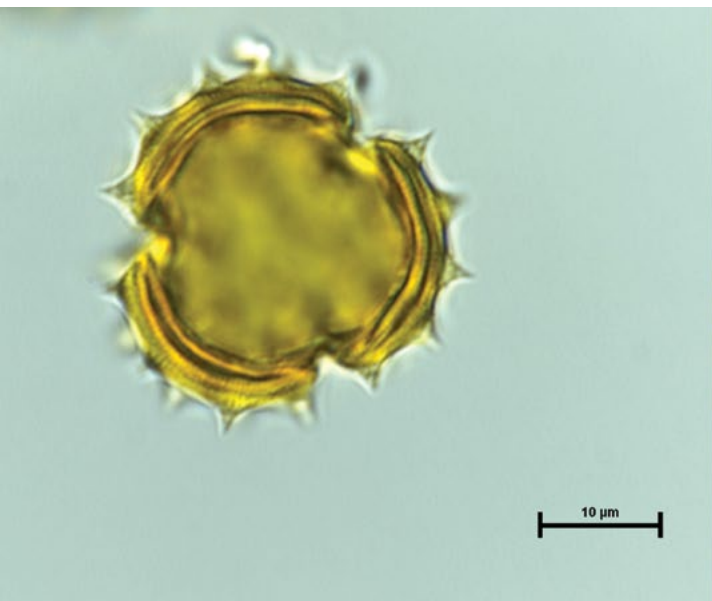
“A strong focus of mine is climate change and it is from the humble pollen grain that we can reconstruct how environments have changed,” says Dr Lynne Quick, a senior researcher in the African Centre for Coastal Palaeoscience (ACCP), in the Department of Botany. Her research speciality is palynology – the study of pollen and spores in living and fossil form.

She explains how the ecology and climate from the distant past provides deep time baselines of variability in natural systems

that can inform current conservation and environmental sustainability efforts.

In 2018, the University tasked Dr Quick with building a pollen lab from scratch; one of the very few in South Africa. The lab is now fully operational, with two palynologists, two postdoctoral fellows and a strong final-year and postgraduate student contingent.

“The research we are currently doing on pollen in fossil deposits is strongly transdisciplinary, and includes botany, archaeology,





geography, geology, all coming together to find solutions to the Sustainable Development Goals of Climate Action (SDG 13) and Life on Land (SDG 15)," says Dr Quick.

For this research they are mainly focusing on the Eastern Cape, which is an under-studied portion of the Cape Floristic Region – a global biodiversity hotspot. "At sites in areas like the Baviaanskloof we are working on different forms of proxy evidence, including fungal spores and charcoal to determine the ties to humans coming into these landscapes.

"From a palaeoclimate perspective, the dominant message from the research is the sub-regional nature of climate," says Dr Quick. "In other words, there is great variability in how climates have changed in the Cape Floristic Region. We cannot make sweeping statements like 'the whole of the region was doing this 10 000 years ago'. From a climate action perspective, we therefore need to be far more nuanced in how we approach climate change mitigation."

This research is informing conceptual models for Quaternary Science in South Africa (the Quaternary period is the last 2.6 million years). Quaternary research explores environmental conditions during this period, and is key to managing processes that will influence the earth's future.

The team is partnering with international researchers, such as Dr Saul Manzano from the University of León in Spain. Another international research collaboration is centred on analysing pollen from dassie middens – a unique archive that provides invaluable palaeoenvironmental data for southern Africa. The main collaborator is leading palaeoclimatologist Dr Brian Chase at the University of Montpellier CNRS, France.

"I have just finished analysing the pollen record from a dassie midden in the Baviaanskloof covering the last 6000 years. The data shows a distinct ecosystem change around 3000 years ago, which is likely related to a major climate shift at that time.

### Pollen alert

Dr Quick and her team are part of the South African Pollen Monitoring Network. "We generate pollen data on a weekly basis to supply to the medical industry. The project, led by the University of Cape Town's Lung Institute, analyses pollen captured in the air and publishes forecasts on a weekly basis for several different parts of the country. Pollen allergies are one of the main sources of hay fever and the good news for residents of Nelson Mandela Bay is that the allergenic pollen levels are never as high here as in Johannesburg or Cape Town."



**"For this research they are mainly focusing on the Eastern Cape, which is an under-studied portion of the Cape Floristic Region – a global biodiversity hotspot."**

"We definitely must worry about climate change," says Dr Quick. "the rate of change we are seeing over the last decade has been so much greater than the natural cycles we have studied. Humans are changing landscapes at a rate that natural landscapes can't keep up with."



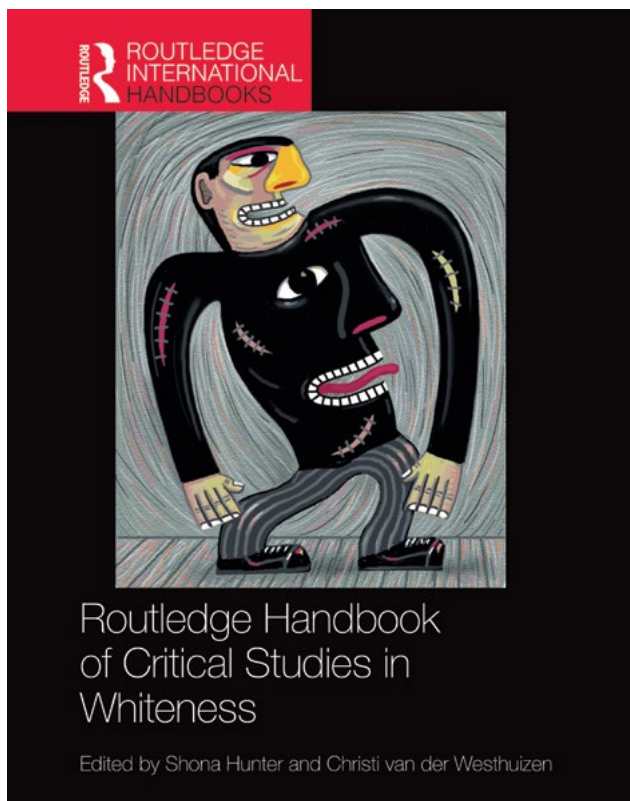
# Overtuning the Myth of Whiteness

“Whiteness is at its best when it turns into a myth. It is the most corrosive and the most lethal when it makes us believe that it is everywhere; that everything originates from it and it has no outside.” – Professor Achille Mbembe, 2015. *Decolonising Knowledge and the Question of the Archive* – online lecture.

“One of the central questions for us at the Centre for the Advancement of Non-Racialism and Democracy (CANRAD) is how to achieve sustainable societies that are more inclusive and equal. In particular, this requires addressing racial injustice,” says CANRAD Associate Professor, Christi van der Westhuizen.

As part of this research, in 2022 Prof van der Westhuizen and Dr Shona Hunter from the Centre for Race Education and Decoloniality, Leeds Beckett University, UK, edited the *Routledge International Handbook of Critical Studies in Whiteness*, a major work in the renowned *Routledge International Handbook* series.

In their opening essay, “Viral whiteness: Twenty-first century global colonialities”, the authors argue for a struggle that “refuses race as the way of organising and defining the human.



## Democracy is in serious danger

CANRAD turned 10 in 2020, but because of the pandemic, its tenth anniversary international online conference was held in 2021. The conference title was “The state we’re in: democracy’s fractures, fixes and features”, and it was attended by 328 people from 19 countries across the world.

“Democracy worldwide is under massive pressure because of rising populism. You see a mobilisation of differences, such as race, ethnicity and nationality, to advance the power of a particular leader or party, including patriarchal power, at the expense of democracy. Putin personifies this, as does the reversal of *Roe v. Wade* (the right to safe abortion services) in the US which has ramifications for women’s human rights globally. A book will be published soon with selected papers from the conference, including on deepening and entrenching democracy as the best system we have for inclusive representation.” – Professor Christi van der Westhuizen.

This refusal is in concurrence with Mbembe’s opposition to the mythologisation of whiteness.”

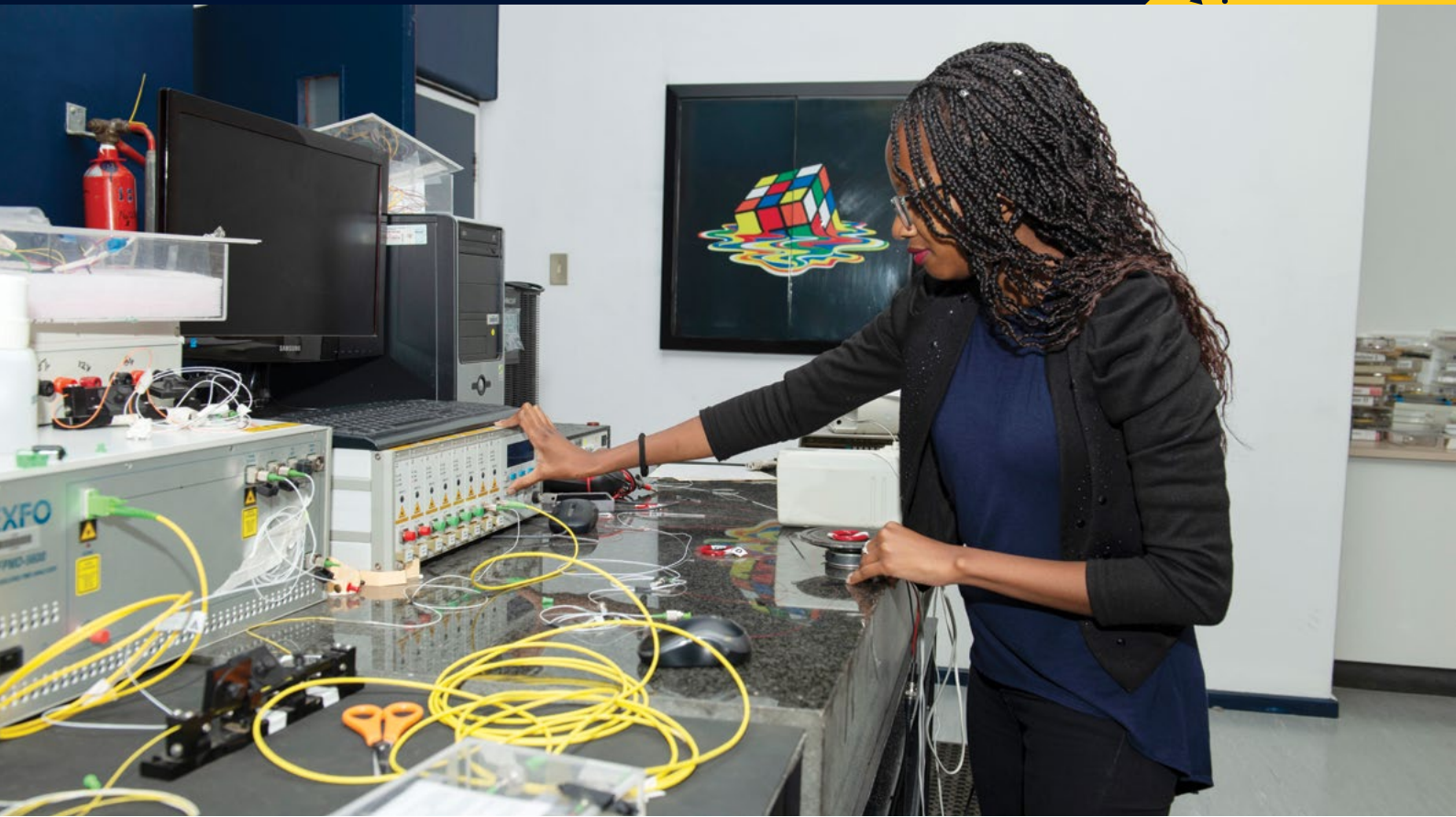
They define whiteness as “a dynamic, shifting, but durable system of domination through, under, against and within which people live, work, and relate”.

Whiteness is analysed in the book in relation to class, nationality, gender and sexuality, looking at widely differing countries, including Japan, Austria, Sweden, Zimbabwe and the US. “Chapters look at the problem of race and racism globally, transnationally as well as nationally,” Prof van der Westhuizen explains. South Africa features in a number of chapters.

“We have the structural legacies of apartheid and colonialism sustaining a racial hierarchy in South Africa that is socio-economically based. At the individual level, everyday racism continues to be a serious problem.”

The book further examines the radical white right. “White supremacism is a backlash against the advances of racial justice because the hierarchy where white people are positioned as superior is being destroyed,” says Prof van der Westhuizen.

# Leading in **Big Science**



“Physics tells the story of the universe. It equips us with tools to invent technologies that discover and shape a new and better world.” – Professor Tim Gibbon, Director of the Centre for Broadband Communication (CBC) and recipient of the University’s Teaching Excellence Award for 2021.

“Our research focus is on innovation in science and engineering to create something really outstanding that can help to change the world,” says Prof Gibbon. This includes transdisciplinary big science projects, including radio astronomy (the Square Kilometre Array (SKA), MeerKAT, HIRAX); 5G telecommunications; robots that explore the oceans; and geosensors that detect earthquakes and sinkholes to save lives.

### **HIRAX and space science**

Through the CBC, in 2021 Nelson Mandela University accepted the invitation to join as a full member in the prestigious HIRAX project. Prof Gibbon explains: “HIRAX (Hydrogen Intensity and Real-time Analysis eXperiment) is a novel radio telescope interferometer, currently in design. It will comprise roughly 1000 close-packed six-metre dishes, deployed at the SKA site in the Karoo.”

“Our research focus is on innovation in science and engineering to create something really outstanding that can help to change the world.”





HIRAX will map most of the southern sky to measure remnant ripples in the distribution of galaxies – baryon acoustic oscillations (BAOs) – imprinted by primordial sound waves that existed in the early universe. The characteristic BAO length scale will be used for charting the history of the universe and for shedding light on the nature of dark energy.

“Our research group of physicists will contribute expertise in optical fibre links,” says Prof Gibbon. They are already known for this specialised instrument work with the SKA and MeerKAT, hence the invitation to join the HIRAX project, which is being led by the University of KwaZulu-Natal.

Prof Gibbon explains: “The universe-scale measuring system depends on optical fibre linked to a supercomputer tasked with crunching the huge volumes of data. This requires the distribution of extremely stable clock signals – to the picosecond stability range – to keep the flow of data in sync.” Gibbon and the CBC’s master’s and PhD students have been researching optical approaches for these networks that are also critical for a range of other uses, such as stock trading, where the microsecond can significantly impact share prices.

“This is a wonderful opportunity for our postgraduate students as they are working on cutting-edge innovation that positions them very well for their future careers. Many of our postgraduates are offered international positions,” says Prof Gibbon.

## Science for society

The Faculty of Science is highly proactive in “Science for Society”. “The offshoot from big science, is that the technologies will be in our homes in a few years’ time,” says Prof Gibbon. “Wi-Fi, for example, was invented by astronomers for big science projects; webcams were invented to remotely monitor science research.”

### Fibre-to-the-home (FTTH)

“The CBC is exploring the concept of leveraging FTTH, 5G and satellite internet networks in an African context to connect villages in Africa’s dispersed, rural populations. We have developed novel technologies that can offer high speed internet everywhere and be cheaply available,” says Prof Gibbon. “Now we need governments, regulatory bodies, business and politics to align. In South Africa there are so few mobile communications service providers that it’s not an open market. By now we shouldn’t be worrying whether we’re connected or whether we have signal or what the speed is; it should be a given and available to everyone.”

### Optical Society of America (OSA) recognises photonics research excellence

In the May 2021 issue of *Optics and Photonics News*, the Optical Society of America (OSA) published a feature article



Prof Tim Gibbon

titled “Optics in Africa: Six Stories”. One of the six success stories, “Questions of Timing”, showcased the CBC’s pivotal contribution to photonics research in areas of optical fibre sensors, timing networks and the SKA.

### Strengthening ties with key British research networks

Prof Gibbon received the 2021/22 Distinguished International Associate award from the British Royal Academy of Engineering.

Dr Shukree Wassan, a PhD physics graduate from the CBC, recently accepted a position at the National Physical Laboratory (NPL) in the UK, where they have a specialised atomic clock that is their country’s time standard. Dr Wassan’s job is to use optical fibre links to distribute the UK’s time standard to institutions like banks and data centres. He developed his unique skill set at CBC during his PhD project within the SKA, developing clock signals between the telescopes.

### Physics and engineering team up in ocean robotics

The CBC is partnering with the Marine Robotics Unit in the University’s School of Engineering in researching and developing a range of novel communication technologies to explore the oceans with autonomous underwater vessels. This includes sensors to measure biodiversity properties in the ocean and communication systems between robots and users.

# VTOL Aircraft Patented



Nelson Mandela University prototype under construction (7,5m wingspan)

The configuration of a design of a vertical take-off and landing (VTOL) aircraft for high payload, extended endurance operations by the Nelson Mandela University's Mandela Autonomous Operations (MAO) Group has been patented.

The aircraft shows promise with regard to increased payload, durability and ease of operation.

The MAO was approached early in 2019 to develop an aircraft capable of the following autonomous mission:

- 50kg payload
- Vertical take-off from an unprepared surface on land
- Flight to a point 50km offshore
- Five minutes of stable hover while taking ocean water samples using a probe lowered into the water
- 50km return flight
- Vertical landing.

According to Professor Russell Phillips, manager of the Renewable Energy Research Group (REG) and the MAO, existing multi-rotor aircraft are not capable of the required mission due to the constraints of current battery technology and the power requirements of rotor craft. Typically, multi-rotor aircraft have a maximum endurance of around 30 minutes regardless of their size.

During normal forward flight, a conventional fixed wing aircraft requires less continuous power to maintain altitude than a rotor craft lifting the same mass. Additionally, a high aspect ratio wing plan form further reduces power requirements.



# Environment drives Eastern Cape Researcher's Education Journey



A love of nature and a passion for teaching have inspired this Mandela Uni academic's mission to educate young children about the importance of creating a sustainable living environment.

**D**r Deidre Geduld is finding ways for teachers to develop practical approaches to appreciating the environment – an initiative sparked during the Covid-19 pandemic, when she became more aware of the ecological crisis.

"For me, that period brought into sharp focus the urgency for Early Childhood Care and Education (ECCE) and foundation phase teachers to develop praxis and pedagogical approaches that inspire hope and possibilities among teachers and children towards addressing this crisis," says Geduld, who has a PhD in education from the institution. "This burning issue adds to the existing stress and traumas experienced by children in a context characterised by widening and deepening injustice, inequality and poverty."

### Practice makes perfect

By using school and community gardens as practical tools, Geduld has established a community of practice with foundation phase teachers at Graslaagte Primary in Humansdorp and the neighbouring Early Childhood Care and Education centre (ECCE) to explore how these areas can be developed into spaces of learning for children.

"I see pupils as connected to the natural environment and they need to understand the fundamental ecological principles of nature, interdependence, species and ecosystems.

"Most importantly, they need to experience wonder and awe towards nature, and feel inspired just by witnessing the sight of nature."

Geduld, who grew up in Gqeberha, had her fascination for learning developed in childhood, thanks to her mother and grandmother.

### Nature as centre

Her research focuses on bringing eco-pedagogical awareness out from the peripheral to the forefront of mainstream education, adding to the ongoing global battle to protect our natural environment.

Geduld's research, which will take five years to complete, will be presented to the department of basic education and the South African Education Research Association to ensure the information is spread widely nationally and globally.

# Fishing in **Uncharted Waters**

The Marine Living Resources Act, 1998 (MLRA), which regulates fishing rights, has a grey area when it comes to residents who have been fishing for themselves for generations. In the past they were classified as ‘subsistence fishers’ (people who fish purely to feed themselves). But when the MLRA was amended in 2016, this definition fell away.

**F**ishing families and communities, who have lived off the sea for generations, may have no protection under the law – this is something that Anthea Christoffels-Du Plessis, a Faculty of Law researcher, is determined to help change.

“There was a class action in 2006/2007 challenging the previous provisions in the Marine Living Resources Act of 1998,” she says, “which also highlighted the shortcomings of the Act when it comes to customary fishers.

“As a result, the South African government was compelled to adopt a more human-rights-based approach and drafted the Small-Scale Fishing Policy. It’s an improvement, but still inadequate. The Small-Scale Fishing Regulations of 2015 and the amended MLRA do not speak to each other.

“For instance, in 2012, fishers from the Dwesa-Cwebe community were arrested and charged for contravening the MLRA, because they were fishing in a marine protected area without a permit. After years of litigation, the SCA finally decided in 2018 that the MLRA neither extinguished nor preserved customary rights, that subsistence and customary fishers were similar but not the same, and that the customary right renders fishing without a permit lawful.”

The effective implementation of law is problematic, she argues, and the role of customary fishing rights remains fragmented, since there is no criteria for classifying customary fishers and resources available to them.

### **Closing the gaps**

Anthea has no connection with fishing or fishing communities, but like any good human-rights public lawyer, she saw a gap in legislation that needed to be filled.

Her research is aimed at proposing a clear and unambiguous definition for a customary fishing right to identify this sector as a distinct class of rights-holders worthy of legal recognition and protection.

Commercial fishing has gobbled up many fishing opportunities, and one of the complaints from commercial fishers is that small-scale fishers infringe on their territories and quotas. However, in Anthea’s opinion, the opposite should be the case: large factory-fish operations should rather be compelled to make way for the small-scale fishers, who have grassroots community involvement and play a role in food security in poor and marginalised communities.



# Better Living through Science

Dr Ngcali Tile's journey from a rural village childhood to pioneering nanotechnology research has been a challenging one – but his determination to succeed in this cutting-edge field is rooted in an appreciation of life beyond electronics.

**B**orn in Mthatha, the Nelson Mandela University PhD in physics graduate worked his way through education with the help of devoted grandparents and government student grants.

Today, he works in the fields of nanophononics and semiconductor development – areas mostly mysterious and little-known among the general populace.

"The electronics industry is built on semiconductors," says Dr Tile. "Semiconductors make up the active portion of many electronic technologies.

"Consider your smart phones, solar panels, scanners, televisions, airport security detectors, etc. The science of manipulating, detecting, emitting and using light is known as photonics (electromagnetic radiation).

"Light may be controlled, produced and detected using semiconductors – meaning that they can be photonic devices. Everything is based on their characteristics."

## A quantum leap

Dr Tile creates new semiconductor materials by utilising various material growth systems. This matters, because he's researching the effects on structural properties of materials – and how this impacts performance.

"I'm primarily interested in developing device structures based on Nitrogen-doped Gallium Arsenide quantum wells and Gallium Antimonide quantum dots in a Gallium Arsenide matrix."

In layman's terms, a quantum well is a very thin semiconductor layer (a few nanometres thick) inside a thicker semiconductor, and a quantum dot is a very small semiconductor particle (nanometre-sized) inside another semiconductor.

The active layer of mid-infrared devices can integrate gallium antimonide quantum dots for use in medical diagnostics, environmental monitoring, military countermeasures, and solar cells.

This nanoscale structure's growth and management is an important scientific challenge, he explains.



"When a very thin layer of the semiconductor material, which is the quantum dot's composition, is put on another material, it creates the quantum dots that I am working on. The top thin substance then self-organises into tiny nanoscale particles because of the tension between the two layers.

"The terms 'self-assembly' or 'self-organisation' refer to this phenomenon. Quantum dots, which are semiconductor structures created in this manner, are self-organised or self-assembled. My research's primary goal is to identify the growth circumstances that cause these structures to emerge."

Understanding how self-organised structures form – and creating the growth circumstances to regulate their morphology – are the first and crucial elements in the development of these structures.



# Dealing with Household Debt Starts at Home

Soaring interest rates are likely to leave many people struggling to pay their debts, with the impact of this fiscal storm felt most acutely by those already working to make ends meet.

The problem of household debt – and how to deal with it – was the subject of Dr Tapuwa Roseline Karambakuwa’s recent research paper, “Determinants of household over-indebtedness in South Africa”, co-authored with Professor Ronney Mcwadi.

The research aims to provide insights into the nature and causes of household debt in South Africa, and to develop a framework for managing it.

Solutions to the credit crunch are urgently needed, as figures keep climbing: repo rates have increased from 5.5% to 6.25% and prime rates – the rate at which commercial banks charge clients when lending money – from 9% to 9.75%.

Financial literacy and protection from predatory lenders are two major factors influencing household over-indebtedness, says Dr Karambakuwa.

“These factors cause families to enter into debt without considering the impact and affordability. Low household disposable income, coupled with rising living costs,

leads to low or no savings, which (in turn) increases household debt.”

Other factors which come into play include gender, the household head’s education level, age, health, employment status, whether the home is rented or owned, and if householders receive social security grants. It is vital that households practise responsibility and consider their ability to repay debts before borrowing from money-lending institutions, says Dr Karambakuwa.

The paper recommends a framework for managing household debt in South Africa based on pillars of success: upskilling households, review of interest rates by money-lenders, debt insurance and bank information disclosure to customers seeking loans.

Ultimately, though, households must take the initiative, trying their best to avoid debt traps, she says. Stakeholders, including learning institutions, also have a part to play in encouraging the National Credit Regulator to empower households about finances.



# Nanoparticle Colon Cancer Treatment: Gold Dust for the Poor?

Could nanoparticle treatment be a cheaper and less invasive way of treating colon cancer?

Postgraduate student and researcher Itumeleng Zosela hopes so. The bioscientist is teaming up with Greenacres Hospital in Gqeberha to begin testing on cancer tumour cells taken from patients.

Colon cancer, the third most common type across men and women, is responsible for about eight percent of cancer-related deaths worldwide.

Zosela, who is doing her PhD in physiology, majoring in nanomedicine, was initially interested in virology, but nanoscience's use of nanoparticles to treat different conditions piqued her interest in cancer diseases.

"This resulted in my research into the treatment of colon cancer through the use of gold nanoparticles (AuNPs)."



## Invisible army

These particles have anti-cancer properties and are so tiny that one can only see them under a high-powered microscope.

When combined with the anti-cancer attributes of certain plant extracts, the mixture can be enhanced in a laboratory and used in combination with photothermal therapy to treat cancer cells.

Her research is unique in that she uses two South African plant species and one from Nigeria. They cannot be named, due to research protocols.

## Equal treatment

The key pillars of her research revolve around the potential treatment being cheaper and less invasive.

While chemotherapy was helpful, it does not only target diseased cells, but also normal ones, has side-effects and attracts non-compliance, since some patients avoid the pain of treatment that may not work.

Her studies on normal and malignant cells found that the nanoparticles combined with the plant extracts caused cell death in the cancer but not in healthy cells.

"That means a less invasive treatment," says Zosela, who grew up in the rural town of Alice in the Eastern Cape.

Conventional treatments are costly and automatically excludes people who can't afford it.

"The treatment that I hope to develop will not be expensive and therefore benefit a much wider range of society."

Because it is easier to access the plants, combined with the fact that they can be worked on at room temperature, it makes her study cheaper compared to others in finding an effective treatment.

She said that although the results of her research into the use of AuNPs looked promising, it still had to be tested on human tumours and in an animal study.

Before obtaining her master's in nanoscience from Nelson Mandela University, Zosela completed degrees in microbiology (BSc) and medical bioscience (honours) at the universities of Pretoria and Western Cape, respectively.



# isiXhosa Maths Challenges under Spotlight



**A Gqeberha educator is hoping to find solutions for student teachers faced with the difficulty of teaching a tough subject to young pupils in isiXhosa.**

**Z**intle Bangiso-Fihla, a foundation phase teacher in Zwide township, is exploring the topic as part of her master's in education degree at Mandela University.

Bangiso-Fihla, who has been teaching for four years, says that in her first year, she struggled to teach mathematics in isiXhosa – and sometimes still does.

The reason, she says, is that university mathematics is taught in English, but in South Africa, foundation phase learners are taught everything in their home language, apart from English, where applicable.

"I remember, as a student, that all the other modules were taught in English, and isiXhosa was the only module that was taught in isiXhosa. But I am expected to go into a classroom where the home language is an African language and to teach those kids in an African language," she says.

### Seeking solutions

Bangiso-Fihla says there is an expectation from universities that once teachers get into the classroom, they will automatically know how to translate their institutional knowledge, taught in English, into an African language.

"I focused on student teachers' experiences because I want to look at their experiences of teaching mathematics in isiXhosa. Can they use isiXhosa academically to help learners develop the skills needed in that grade?"

"I'm hoping that the results from the study will contribute to potentially assisting Nelson Mandela University to identify the resources that are needed to support the students, because they are the ones (the institution is) going to be sending to classrooms after they qualify."

The 29-year-old from Queenstown says her interest in wanting to find solutions in the education space stems from her passion for the profession.

Initially, Bangiso-Fihla studied psychology, and then went on to enrol for a teaching qualification.

Bangiso-Fihla argues that it makes no sense for universities in the Eastern Cape, where isiXhosa is the most spoken language, to not offer teaching in isiXhosa; and yet student teachers go out to teach isiXhosa-speaking children. She hopes that the research will contribute to the promotion of the use of African languages for teaching and learning in higher education.

# Unveiling Key Economic Issues

Nelson Mandela University Researcher of the Year, Professor Andrew Phiri, from the Faculty of Business and Economic Sciences, draws on interdisciplinary econometric research to unveil key economic issues.

“The goal of my research is to suggest economic policy decisions that will improve people’s well-being,” says Prof Phiri. “As academics, we share our research findings with government and hope they listen. I think there is a strong need for academics in government who can convert specialist research into policy.”

Prof Phiri explains that, as an economist, he does not believe you can research one policy in isolation of the others. “Since well-being is multifaceted, my research uses sharp econometric tools to determine how fiscal policy, monetary policy, trade policy and environmental policy affect the economy and people’s well-being.”

Prof Phiri separates his research into four parts, in collaboration with the three PhDs he supervised, who graduated in 2021.

### Monetary policy

Prof Phiri and Dr Thando Mkhombo looked at both the domestic and international effects of the South African Reserve Bank’s monetary policy. “We found that the Reserve Bank is primarily responsible for the financial stability of our neighbouring countries. If the Reserve Bank was nationalised, institutional independence would be compromised, which would endanger not only the domestic economy but that of the whole region.”

They also found the Reserve Bank has successfully curbed inflation since adopting inflation targeting in 2001. “Our research indicates an optimal inflation rate of 5%, which is near the mid-point of the current 3-6% target. Even though inflation is currently  $\pm 8\%$ , due to global factors such as the Russia-Ukraine war and higher oil prices, our research indicates that the Reserve Bank will successfully steer future inflation down to its target.”

### Fiscal policy

Dr Kambale Kavese ran a computable general equilibrium model (CGE) of government spending in all the provinces. He found that government spending promotes low-skilled labourers (and not highly-skilled ones), and benefits the lives of rich households, while poor, coloured communities benefit the least. The researchers then performed simulations to inform government where expenditure patterns need to change.

“We found that the Reserve Bank is primarily responsible for the financial stability of our neighbouring countries. If the Reserve Bank was nationalised, institutional independence would be compromised, which would endanger not only the domestic economy but that of the whole region.”

Dr Kavese further found that all the monies collected by the South African Revenue Service (SARS) are “revenue maximising” taxation (this form of taxation maximises the taxes SARS can get from people) whereas South Africa should target “growth maximising” taxation, which is lower than revenue maximising taxation and stimulates economic growth.

### International or trade policy

PhD student Sibusisiwe Mchani created a novel trade data set that measures the prestige of trade partners. “The idea is that who we trade with matters for our well-being, and the question is whether to trade with countries with a high prestige index. The answer is ‘yes’ and ‘no,’” explains Prof Phiri, “because

China, for example, has a high prestige index but it is widely known that the trade relationship between China and South Africa needs to be reconfigured, as it is benefiting them more than us.”

**Environmental policy – the most important of them all**

Dr Isaac Doku is doing his postdoctoral research on climate financing, and has found that the amount pledged by developed countries (which have contributed the most to carbon emissions) to African countries (who are suffering the most from climate change), is way below what it should be for African countries to mitigate and adapt to climate change.

Currently the funding is about US\$100 million annually per country. According to Dr Doku’s research, it should be at least US\$1 billion but closer to US\$1.6 billion annually per country for their carbon emissions alone. Dr Doku is presenting this research at international conferences and hopes that it will reach the relevant policymakers.

“China, for example, has a high prestige index but it is widely known that the trade relationship between China and South Africa needs to be reconfigured, as it is benefiting them more than us.”



Professor Andrew Phiri

# Research Awards



## Researcher of the Year

Andrew Phiri

Faculty of Business and Economic Sciences

*"As is the case with mankind, it is really doubtful that any economy can truly prosper without being highly sacrificial."*



## Lifetime Contribution to Research Excellence

Graham Kerley

Faculty of Science

*"Being inspired by the wealth of nature and its relevance to society and future generations makes my work worthwhile, fun and exciting."*



## Emerging Researcher of the Year

William Goosen

Faculty of Science

*"It doesn't matter what you do in life, as long as you are able to do it with enthusiasm."*



## Research Excellence Award

Janine Adams

Faculty of Science

*"I am dedicated to training next generation coastal scientists, ensuring that research links science, policy and management through extensive collaboration."*



**Research Excellence Award**

**Bastien Linol**

AEON-ESSRI

*"To approach a problem in nature, start by making a map of the environment."*



**Faculty Researcher of the Year**

**Khaled Abou-El-Hossein**

Faculty of Engineering, the Built Environment and Technology

*"The best research you can do is when you run experiments and acquire data yourself."*



**Faculty Researcher of the Year**

**Janine Adams**

Faculty of Science

*"I am dedicated to training next generation coastal scientists, ensuring that research links science, policy and management through extensive collaboration."*



**Faculty Researcher of the Year**

**Sylvan Blignaut**

Faculty of Education

*"Research is akin to shining a light into dark areas of our lives to understand social reality better."*



**Faculty Researcher of the Year**

**Joanna Botha**

Faculty of Law

*"Be curious, be brave, believe in your work and you will inspire change."*



**Faculty Researcher of the Year**

**Luvuyo Ntombana**

Faculty of Humanities

*"Intellectualism is missing in modern religions; true spirituality is using the mind to see that which is beyond the mind."*



**Faculty Researcher of the Year**

**Andrew Phiri**

Faculty of Business and Economic Sciences

*"As is the case with mankind, it is really doubtful that any economy can truly prosper without being highly sacrificial."*



**Faculty Researcher of the Year**

**Ilse Truter**

Faculty of Health Sciences

*"Research starts with courageous curiosity ... the flame of one candle in the unknown darkness will soon light many more candles."*





**Faculty Emerging Excellent  
Researcher of the Year**

**Margie Childs**

Faculty of Education

*"Effective learning environments allow space and place for students and lecturers to relate to each other and the world."*



**Faculty Emerging Excellent  
Researcher of the Year**

**Johan Cronje**

Faculty of Health Sciences

*"Every moment is an opportunity to learn something new."*



**Faculty Emerging Excellent  
Researcher of the Year**

**William Goosen**

Faculty of Science

*"It doesn't matter what you do in life, as long as you are able to do it with enthusiasm."*



**Faculty Emerging Excellent  
Researcher of the Year**

**Luyolo Mahlangabeza**

Faculty of Business and Economic Sciences

*"That fire from within a person has to burn strongly enough to overcome any challenges one comes across."*





**Faculty Emerging Excellent  
Researcher of the Year**

**Sibulele Mtakati**

Faculty of Engineering, the Built  
Environment and Technology

*"Try, try and try again."*



**Faculty Emerging Excellent  
Researcher of the Year**

**Thanduxolo Qotoyi**

Faculty of Law

*"The measure of a society is how it treats  
its most vulnerable."*



**Faculty Emerging Excellent  
Researcher of the Year**

**Zintle Sikhunyana**

Faculty of Business and Economic Sciences

*"Fruits of empowerment are best realised when  
the voice of the would-be empowered is  
heard and taken into account."*





# Research Facts and Figures 2021

## NRF rated researchers

Faculty	Name	Rating category	Rating period	Gender	Race	New/ re-evaluation
<b>Arts (total: 4)</b>						
	Boswell, R, Prof	C1	2018-2023	F	B	
	Crous, ML	C3	2018-2023	M	W	
	Hurst, A Dr	C3	2018-2023	F	W	
	Janse van Vuuren, HE, Prof	C2	2019-2024	F	W	
<b>Business and Economic Sciences (total: 4)</b>						
	Farrington, SM, Dr	C2	2019-2024	F	W	
	Fourie, H, Prof	C3	2017-2022	M	W	
	Makuwira, J, Prof	C2	2016-2021	M	B	
	Venter, E, Prof	C1	2018-2023	F	W	
<b>Education (total: 4)</b>						
	Blignaut, SE, Prof	C3	2016-2021	M	B	
	de Lange, N, Prof	C1	2019-2024	F	W	
	Singh, P, Prof	C2	2017-2022	M	B	
	Webb, P, Prof	C1	2019-2024	M	W	
<b>Engineering, the Built Environment and Technology (total: 9)</b>						
	Abou-El-Hosseini, Dr	C2	2016-2021	M	B	
	Emuze, FA, Prof	C3	2019-2024	M	B	
	Hattingh, DG, Prof	B3	2018-2023	M	W	
	Pottas, D, Prof	C3	2014-2019	F	W	
	Shakantu, W, Prof	C3	2017-2022	M	B	
	Smallwood, JJ, Prof	C2	2020-2025	M	W	
	Van Greunen, D, Prof	C2	2018-2023	F	W	
	Van Wyk, BJ, Prof	C3	2017-2022	M	W	
	Von Solms, R, Prof	B2	2021-2026	M	W	
<b>Health Sciences (total: 2)</b>						
	Truter, I, Prof	C2	2017-2022	F	W	
	Ten Ham-Baloyi, W, Dr	Y2	2019-2024	F	W	
<b>Law (total: 1)</b>						
	Vrancken, PHG, Prof	C1	2019-2024	M	W	
<b>Science (total: 61)</b>						
	Adams, JB, Prof	C1	2016-2021	F	W	
	Anandjiwala, R, Dr	C3	2019-2024	M	B	
	Agyingi, C, Dr	Y2	2018-2023	M	B	
	Appadu, R, Prof	C2	2021-2026	M	B	
	Barton, B, Prof	C2	2020-2025	F	W	
	Booth, GL, Prof	C1	2018-2023	M	W	
	Calitz, A Prof	C1	2020-2025	M	W	
	Christopher, AJ, Prof	B3	2018-2023	M	W	
	Cowling, RM, Prof	A1	2021-2026	M	W	
	Connan, M, Dr	C3	2017-2022	F	W	
	Dabrowski, JM, Dr	C2	2020-2025	M	W	
	Dallas, HF, Dr	C2	2016-2021	F	W	

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	Downing, TG, Dr	C1	2018-2023	M	W	
	Du Plessis, M, Dr	C2	2020-2025	M	W	
	Engelbrecht, JAA, Prof	C2	2018-2023	M	W	
	Ferg, EE, Dr	C2	2021-2026	M	W	
	Fritz, H	C1	2018-2023	M	W	
	Frost, CL, Prof	C2	2021-2026	F	B	
	Gerber, TIA, Prof	C1	2018-2023	M	W	
	Gibbon, T, Assoc Prof	C2	2020-2025	M	W	
	Govender, S, Dr	Y2	2016-2021	F	B	
	Grant, CC, Dr	C3	2012-2023	F	W	
	Groenewald, NJ, Prof	C1	2018-2023	M	W	
	Hayward, MW, Dr	B3	2019-2024	M	W	
	Janse van Vuuren, A, Dr	Y2	2020-2025	M	W	
	Kakembo, V, Prof	C1	2019-2024	M	B	
	Kerley, GIH, Prof	B3	2018-2023	M	W	
	Kraaij, T, Dr	C2	2020-2025	F	W	
	Landman, M, Dr	C3	2021-2026	F	W	
	Leitch, AWR, Prof	C3	2018-2023	M	W	
	Little, KM, Dr	C2	2021-2026	M	W	
	Linol, BL, Dr	Y2	2018-2023	M	W	
	Lombard, A, Prof	B2	2021-2026	F	W	
	Marean, C, Prof	A2	2018-2023	M	W	
	Miranda, NAF, Dr	C3	2020-2025	M	W	
	Motlounq, S, Prof	Y2		M	B	
	Nagiah, S,Dr	Y2	2021-2026	F	B	
	Neethling, JH, Prof	B1	2019-2024	M	W	
	Nel, JL	B3	2019-2024	F	W	
	Nel, P, Dr	C2	2016-2021	F	W	
	O'Connell, JH, Dr	Y1	2016-2021	M	W	
	Olivier, EJ, Dr	Y2	2016-2021	M	W	
	Pichegru, L, Dr	C2	2017-2022	F	W	
	Pistorius, PA, Dr	C1	2017-2022	M	W	
	Perissinotto, R, Prof	B2	2016-2021	M	W	
	Potts, A, Dr	P	2019-2024	M	W	
	Pretorius, CJ, Dr	Y2	2021-2026	M	W	
	Prins, AL, Dr	C2	2021-2026	M	B	
	Rautenbach,C, Dr	Y2		M	W	
	Roux, D, Prof	B3	2017-2022	M	W	
	Scholtz, BM, Dr	C3	2017-2022	F	W	
	Strydom, NA, Dr	C2	2017-2022	F	W	
	Tshentu, Z, Prof	C2	2021-2026	M	B	
	Venter, A, Prof	C2	2021-2026	M	W	
	Venter, JA, Dr	C3	2020-2025	M	W	
	Van de Venter, M, Prof	C2	2017-2022	F	W	
	Van Dyk, EE, Prof	C2	2018-2023	M	W	
	Veldsman, S, Prof	B2	2016-2021	M	W	
	Watts, P, Prof	B1	2021-2026	M	W	
	Weigt, M, Dr	C2	2021-2026	M	W	
	Wesson, JL, Prof	C2	2018-2023	F	W	
<b>Total rated researchers: 85</b>				<b>F = 28</b>	<b>B = 17</b>	
				<b>M = 57</b>	<b>W = 68</b>	



## Research outputs

There has been a steady increase in research outputs in the past five years, with Nelson Mandela University showing a consistent, upward, improvement trend. \*2021 numbers are still preliminary and await final approval by the Department of Higher Education and Training.

	2015	2016	2017	2018	2019	2020	2021
Books and chapters	10.05	30.84	22.52	35.48	21	60.06	21
Conference proceedings	63.64	84.09	54.23	41.93	49.6	24.86	40.41
Journal articles	324.81	319.4	312.33	349.93	389	472.45	494.90

## Postdoctoral fellows over the past five years

Year	Number of postdoctoral fellows
2016	54
2017	52
2018	61
2019	70
2020	70
2021	100

## Research Fellows in 2021

Title	Surname	Initial	Full Names	Gender	Race	Department	Faculty
Dr	Botha	M	Marisa	Female	White	CriSHET	Humanities
Dr	Gurbois	C	Chloé	Female	White	Sustainable Research Unit	Science
Dr	Connan	M	Maelle	Female	White	Botany	Science
Dr	Pichegru	L	Lorien	Female	White	Botany	Science
Dr	Linol	B	Bastien	Male	White	Geosciences	Science

## Research entities

Number of research units	6
Number of research centres	13
Number of research institutes	3
Total number of research entities	22

## Details of Research Entities

No.	Name	Acronym	Leader	Faculty	Contact number	Email address
<b>Institutes in faculties (1)</b>						
1	InnoVenton: Institute for Chemical Technology and Downstream Chemical Technology Station and its sub-entities	InnoVenton/ DCTS	Dr G Dugmore (interim)	Science	041 504 3482	Gary.Dugmore@mandela.ac.za



No.	Name	Acronym	Leader	Faculty	Contact number	Email address
<b>Centres in faculties (12)</b>						
1	Built Environment Research Centre	BERC	Mr Chris Allen	EBEIT	041 504 2394	chris.allen@mandela.ac.za
2	Centre for Community Technologies	CCT	Prof D van Greunen	EBEIT	041 504 2090	Darelle.vanGreunen@mandela.ac.za
3	Centre for Research in Information and Cyber Security	CRICS	Prof R Botha	EBEIT	041 504 3179	ReinhardtA.Botha@mandela.ac.za
4	Centre for African Conservation Ecology	ACE	Prof Graham Kerley	Science	041 504 2308	Graham.Kerley@mandela.ac.za
5	Centre for High Resolution Transmission Electronic Microscopy	HRTEM	Prof J Neethling	Science	041 504 2143	Jan.Neethling@mandela.ac.za
6	Centre of Expertise in Forecasting	CEF	Prof I Litvine	Science	041 504 2764	Igor.Litvine@mandela.ac.za
7	Centre for Rubber Science and Technology	CRST	Prof P Hlangothi	Science	041 504 2437	Percy.Hlangothi@mandela.ac.za
8	Telkom Centre of Excellence	CoE	Prof Janet Wesson	Science	041 504 2323	Janet.Wesson@mandela.ac.za
9	African Centre for Coastal Palaeoscience	ACCP	Dr Jan de Vynck	Science	041 504 2397	jan.devynck@mandela.ac.za
10	Centre for Broadband Communication	CBC	Prof T Gibbon	Science	041 504 2141	Tim.Gibbon@mandela.ac.za
11	Centre for Philosophy in Africa	CPA	Dr Mutinda Nzioki	Humanities		sam.nzioki@mandela.ac.za
12	Raymond Mhlaba Centre for Leadership and Governance	RMCL	Prof Luvuyo Ntombana	Humanities		luvuyo.ntombana@mandela.ac.za
<b>Units in faculties (6)</b>						
1	Family Business Unit	FBU	Dr Shelly Beck	Business & Economic Sciences	041 504 1392	Shelly.Beck@mandela.ac.za
2	Unit for Positive Organisations	UPO	Prof M Mey	Business & Economic Sciences	041 504 2360	Michelle.Mey@mandela.ac.za
3	Unit for Economic Development and Tourism	UFEDT	Prof R Ncwadi	Business & Economic Sciences	041 504 3834	Ronney.Ncwadi@mandela.ac.za
4	Unit for Visual Methodologies for Social Change	UVMSC	Prof N de Lange	Education	041 504 4519	Naydene.deLange@mandela.ac.za
5	Drug Utilisation Research Unit	DURU	Prof Ilse Truter	Health Sciences	041 504 2131	Ilse.Truter@mandela.ac.za
6	Sustainability Research Unit	SRU	Prof Herve Fritz	Science	044 801 5121	herve.fritz@mandela.ac.za
<b>Entities reporting to dvc: university based (3)</b>						
1	AEON - Earth Stewardship Research Institute		ESSRI	Dr Moctar Doucoure	041 504 4611	Moctar.Doucoure@mandela.ac.za
2	Institute for Coastal and Marine Research		ICMR	Prof. Lorien Pichegru	041 504 2649	lorien.pichegru@mandela.c.za
3	Centre for Women and Gender Studies		CWGS	Dr Babalwa Magoqwana		Babalwa.magoqwana@mandela.ac.za

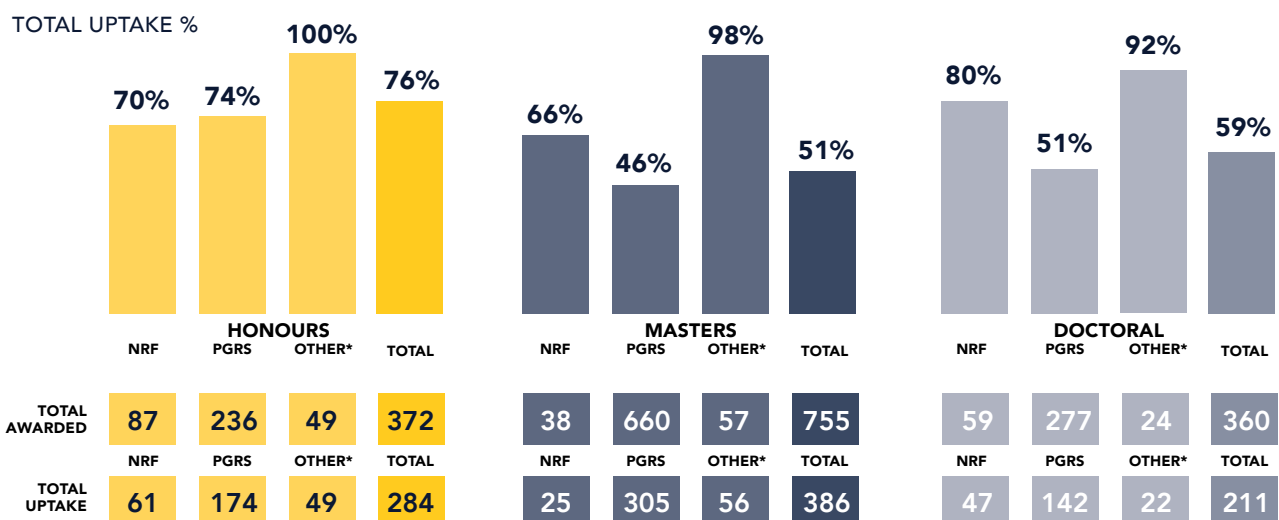


## Research Chairs

No.	Title of chair holder	Initial	Name of chair holder	Name of research chair	Affiliation on RPMS (department, faculty)
1	Professor	AM	Hurst	SARChi Chair in Identities and Social Cohesion in Africa	Philosophy, Humanities
2	Professor	AT	Lombard	SARChi Chair in Marine Spatial Planning	ICMR, DvC RII
3	Professor	J	Adams	SARChi Chair Shallow Water Ecosystems	Botany, Science, ICMR
4	Professor	P	Watts	SARChi Chair Microfluidic Bio/ Chemical processing	Chemistry, Science
5	Professor	P	Vrancken	SARChi Chair in Law of the Sea	Law
6	Professor	MJ	Roberts	SA-UK Bilateral Chair in Food Security	ICMR, DVC RII
7	Professor	A	Keet	Chair for Critical Studies in Higher Education Transformation	CriSHET
8	Professor	SJ	Mbanga	Chair in Human Settlements	Building and Human Settlements, EBET
9	Professor	I	Gorlach	Isuzu Chair in Mechatronics	Mechatronics, EBET
10	Mr	K	du Preez	merSETA: Engineering Development	Engineering, EBET
11	Professor	S	Vally	DHET/DST SARChi Chair in Community Adult and Worker Education (hosted with UJ)	Hosted by UJ
12	Professor	C	Walter	UNESCO Chair in Physical activity and Health in Educational Settings. Co-hosted with University of Basel, Switzerland	Human Movement Science, Health Science
13	Dr	L	Powell	Research Chair: Youth Unemployment, Employability & Empowerment	CriSHET, DVC ET
14	Professor	R	Boswell	Ocean Cultures and Heritage	Sociology and Anthropology, Humanities, ICMR
15	Professor	P	Gqola	African Feminist Imaginations	Sociology, Humanities, CWGS
16	Dr	M	Mufamadi	DSI – Mandela Research Chair in Nanomedicine	Medical School, Health Sciences

## Postgraduate research funding awarded

### POSTGRADUATE SCHOLARSHIPS THAT HAVE BEEN AWARDED AND TAKEN UP 2021



## Research income from research outputs

	2014	2015	2016	2017	2018	2019	2020	2021
M and G graduations	R57 806 901	R54 256 618	R63 800 377	R70 680 385	R78 011 797	R71 195 822	R 62 612 697	R65 459 339
Research publications	R39 783 772	R42 728 078	R47 467 383	R47 924 606	R55 851 564	R61 683 448	R73 668 485	R75 781 560



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Lead writers: Heather Dugmore and Gillian McAinsh

Copy-editing: Jill Wolvaardt

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# Change the World

PO Box 77000,  
Nelson Mandela University  
Gqeberha, 6031

[info@mandela.ac.za](mailto:info@mandela.ac.za)



[mandela.ac.za](http://mandela.ac.za)