

NELSON MANDELA

UNIVERSITY



RESEARCH & INNOVATION REPORT 2019/20



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VC's Foreword: Research and Innovation in the Service of Society

In pursuit of its vision, Nelson Mandela University positions itself in a manner congruent with its strategic aspiration to foster a culture of vibrant research, innovation and internationalisation (RII) in the service of society. Furthermore, as the only university in the world carrying the name of Nelson Mandela, we embrace the ethos and values of our iconic namesake, particularly his lifelong struggle for a humane, democratic society where all citizens are treated with dignity.

In 2019, the University reviewed progress made in implementing its decadal Vision 2020 strategic plan and looked ahead at developing a fresh blueprint for the next decade to inform the Vision 2030



Prof Sibongile Muthwa

strategy. As part of these processes, Council approved the institutional research and innovation strategy during 2019, which includes intensified efforts to ramp up research output, productivity and impact as a key dimension of the University's reputation and sustainability.

To this end, it is pleasing to note that the research publication outputs of the University increased by 11% from 429 in 2018 to 474 in 2019. This contributed to the total weighted research output units of the University remaining stable at 1027 from 2018 to 2019, in spite of a decline in master's and doctoral enrolments and research output units over the past two years. As a crucial precondition of revitalising the academy, the University is exploring strategies to expand the pool of postgraduate students through improved financial support and expanding postgraduate supervisory capacity across all faculties.

As a comprehensive university, Mandela University is poised to facilitate the convergence of inter- and transdisciplinary "blue sky" and applied research as a centrepiece of progressive scholarly inquiry in response to the major challenges of our time, such as poverty, the burden of disease, global inequality and environmental degradation. This is part of a broader strategy to reconfigure the University in alignment with a reimagined and non-paternalistic paradigm of engagement that can more meaningfully engage with, and contribute to, alleviating human precarity.

The University views engagement as 'convergence', or the equalising and coming-together of university and community to create new knowledge and to draw on the existing and historic knowledge and insights of all our communities and stakeholders. Engagement and social responsiveness therefore permeate all facets of our learning, teaching, research and innovation, intrinsically linking our scholarly endeavours with the quest to address the major societal challenges of our time, with the COVID-19 pandemic being an exemplar.

The strategic commitment by Nelson Mandela University's Council to invest in areas as academically diverse as the new medical school, ocean sciences and revitalising the humanities constitutes part of our concerted effort to position and foreground our University's distinctive areas of competitive strength.

Transforming health sciences education

From the outset of the COVID-19 pandemic, our academics and

faculties have been collaborating with hospitals, communities, government and businesses in the Nelson Mandela Bay Metro and broader Eastern Cape to help mitigate the devastating impact of the virus. These efforts included working closely with clinicians and health workers to support them and respond to their needs, producing much-needed sanitisers, face shields and intubation/extubation units, and reaching out to vulnerable and marginalised communities worst affected by the pandemic.

Our university is mourning the loss of five staff members to COVID-19, including the Executive Dean of our Faculty of Health Sciences, Professor Lungile Pepeta. He led our University's COVID-19 offensive from the front and was working on systems and strategies in the province and nationally to fight the virus. His exposure to the virus was too great and he was sadly taken from us on 7 August 2020. Professor Pepeta was instrumental in driving our efforts to transform health sciences education towards establishing the tenth medical school in the country and we will continue to honour his legacy as we welcome the first cohort of medical programme students in 2021.

Addressing the crisis in basic education

A key area of engagement in which we are participating at several levels is the crisis in basic education, which has been further heightened by the challenges caused by COVID-19 in a deeply unequal schooling system. As part of the solution, the Faculty of Education's Centre for Community Schools (CCS) continued to work with under-served schools and communities to develop alternative approaches to school improvement that are relevant and responsive to contextual realities.

The Govan Mbeki Maths Development Centre also implements a range of mathematics and science development and support projects for learners in township and rural schools in the Eastern Cape and nationally. More than 700 selected learners from schools across the province benefitted from the TouchTutor® programme, which gives them access to university studies.

Furthermore, through the work of the Centre for Community Technologies, various groundbreaking apps and web-based solutions have been developed for the benefit of disadvantaged communities, such as: electronic health records for use by community healthcare workers; digitised adult primary healthcare guidelines; a mental health app; and the Ncediso app, which allows for the early detection of various disabilities and diseases.

Within the context of the Fourth Industrial Revolution, it is important to introduce learners to coding at a young age. There is a desperate shortage of developers globally and, without access to computers, most South African learners cannot pursue this as a career option. To overcome this, the Computing Sciences Department developed an educational gaming app called TANKS, which enables school learners to build a code with a smartphone and customised puzzle pieces. In recognition of this pioneering work, TANKS was a runner-up in the 2019 Africa Tech Week award for the Technology Innovation of the Year as well as the Nelson Mandela University Innovation Excellence Award.

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Revitalising the humanities

Revitalising the humanities is a core component of the University's overall academic strategy to reimagine the transformative potential of all disciplines in the quest to awaken African scholarship and systems of thought. This will contribute to the University's efforts in building social cohesion and democratic citizenship through fostering the depth of critical thinking required to engage creatively in identifying innovative solutions and approaches.

Progress towards achieving this in 2019 included, inter alia, the launch of the Centre for Philosophy in Africa and the SARCHI Chair for Identities and Social Cohesion in Africa. The University also launched the Centre for Women and Gender Studies (CWGS) in October 2019 to research and foreground African women's biographical thinking, intellectual production, and political histories.

Responding to the debates about the decolonisation of universities, the Chair for Critical Studies in Higher Education Transformation (CriSHET) is driving the transformation agenda by grounding it in critical studies and framing it within the concept of an African-purposed curriculum. Under the rubric of Critical Mandela Studies,

the Transdisciplinary Institute for Mandela Studies (TIMS) was endorsed by Senate and Council in 2019 and will constitute a key intellectual differentiator for the University.

Accelerating ocean sciences

Several important partnerships, both nationally and internationally, have assisted the University in deepening our impact in the transdisciplinary spheres of ocean sciences. On a global scale, we are partners in the One Ocean Hub initiative, a research project seeking to tackle threats to the world's oceans, such as plastic pollution, over-fishing and acidification. Our SARCHI Chair in the Law of the Sea and Development in Africa, Professor Patrick Vrancken, fulfils the role of the regional lead for the project on the African continent.

In addition, the support from the Norwegian Embassy for the interventions led by our FishFORCE Academy has enabled our University to establish training academies in several African coastal countries, such as Kenya, Tanzania, Mozambique, Namibia and Angola. This initiative seeks to provide legal training in ocean governance to reduce illegal fishing, poaching and related crime on our high seas, such as human and drug trafficking. The original grant of approximately R50-million has received a further boost of R38-million.

One of our long-standing international partnerships is with the University of Southampton (UoS), UK, initially established through our SARCHI Chair in Ocean Science and Marine Food Security, and now including Marine Engineering and Naval Architecture. Nelson Mandela University's first Naval Architecture doctoral candidate, Boswell Douse, is currently pursuing his PhD at the University of Southampton.

New engineering technologies

The Second International Indian Ocean Expedition (IIOE-2) selected Nelson Mandela University to be the hub for marine robotics as part of a research network of Western Indian Ocean partners. In March 2019, the Faculty of Engineering, the Built Environment and Technology (EBET) launched its transdisciplinary Marine Robotics Unit, enabling oceanographic researchers to collect data in situ using robotic technologies.

The Faculty of EBET has also embarked on an ambitious Cross Laminated Timber (CLT) initiative in a partnership intended to advance the revolutionary CLT construction process. The new CLT Engagement Unit is partnering with an Italian construction company, Innovhousing, and a growing number of university and industry partners to transform the technology of building globally.

Professor Danie Hattingh, Director of eNtsa (Innovation through Engineering Institute) was one of the 2020 winners of the Honorary Medal of the Faculty of Natural Science and Technology, awarded by the South African Academy for Science and Art for exceptional work. Professor Hattingh and his team were honoured for their contribution to the field of friction welding and the associated development of the analysis of metal turbines and high pressure/high-temperature pipes. These techniques, currently being used

at both Eskom and Sasol, are crucial to the supply of electricity to South Africa.

Over the past year, the University has made incredible strides in advancing these and other areas of research, innovation and internationalisation despite the wide-ranging impacts of the global pandemic. I wish to acknowledge and honour the contributions of all those who have courageously persevered through this difficult period in our history. As we step into the next decade, the University will continue to make strides in the pursuit of learning and teaching, research, innovation, and engagement that contribute to the advancement of a more inclusive, socially just world for all.

Professor Sibongile Muthwa
Vice-Chancellor

"The strategic commitment by Nelson Mandela University's Council to invest in areas as academically diverse as the new medical school, ocean sciences and revitalising the humanities constitutes part of our concerted effort to position and foreground our University's distinctive areas of competitive strength."

New Possibilities for Impactful, Catalytic Research

By Dr Thandi Mgwebi, Deputy Vice-Chancellor: Research, Innovation and Internationalisation (RII)

Nelson Mandela University welcomed Dr Thandi Mgwebi as the new Deputy Vice-Chancellor: Research, Innovation and Internationalisation (RII) from 1 April 2020.

Dr Mgwebi shares her insights.

The University community has had to navigate many rough seas in recent and not so recent history. In this era of the COVID-19 pandemic we find ourselves facing another very rough sea without any confirmation of calmer waters ahead.

This has put knowledge workers and research institutions in the spotlight and amplified our role in advancing research and engagement to offer innovative solutions that address the challenges we face as a country, continent and world.

COVID-19 has accelerated digital transformation at universities and in the workplace in general. Automation, digitalisation and artificial intelligence have become fundamental drivers of our reality. They are no longer outlandish concepts for screenwriters' pleasure. As universities, we have bravely stepped up to the digital world, which demands not only an "unlearning" of old ways, but also requires an interconnectedness that seeks engagement across multiple levels and across knowledge disciplines.

As Mandela University, we are committed to increasing and strengthening global connections, collaborations and contributions, particularly within our continent. For who better to carve the solutions for Africa's unique problems than those researchers with a vision and voice rooted in Africa? Our partnerships with business, government and industry continue to be a source of strength and support our drive for co-creation of knowledge for societal benefit.

The catalytic initiatives we have achieved through our relationships with government and international partners need to be leveraged for even greater benefit. The impact goes far beyond the specific challenge of the COVID-19 pandemic to address the range of wicked problems facing the world, as addressed in the United Nations' Sustainable Development Goals (SDGs) and African Union Agenda 2063.

At Mandela University we are looking to significantly expand our reach and increase our research activity and productivity. To achieve this, we need agile systems that enable access to windows of opportunity. It also requires the translation of research into impactful products and services.



Dr Thandi Mgwebi

We are leaders on the continent in a range of fields, including ocean science, nanotechnology, women and gender studies, and marine robotics, to name a few.

We are undertaking large-scale projects that distinguish us, led by distinguished scholars and researchers such as Professor Azwindini Muronga, who has cultivated strategic partnerships with international centres such as the CERN, the European Organization for Nuclear Research.

We have Professor Mike Roberts, who holds the SARCHI Chair in Ocean Science and Marine Food Security. The Chair is jointly hosted by Nelson Mandela University, the University of Southampton and the National Oceanography Centre, UK. Professor Pumla Gqola,

a pathfinder in African feminist imaginations has recently joined us. We have so many outstanding scholars and researchers at our University and we need to fly our flag high.

As the newly appointed Deputy Vice-Chancellor of RII, I am excited to step into the position at a time when Mandela University is carving its Vision 2030, to become even more relevant in contributing to solving society's challenges. Our intention is to expand our sphere of influence through greater internationalisation and diverse networks so that we remain globally relevant while working on local and continental solutions.

Such networks stimulate our researchers and sustain their performance, with healthy cross-pollination between academics and across continents. Closer to home, we will find greater opportunities for engagement not only to benefit our communities but also to enrich the experiences of both staff and students.

Throughout this holistic approach we will always be guided by our moral duty as researchers to ensure that we remain relevant by working for society, and engaging with society, to the benefit of society. What excites me are new possibilities for impactful, catalytic programmes to undertake novel research, and to widen our postgraduate student opportunities and offerings, such as through jointly recognised PhDs. One such opportunity is now possible as a result of the cotutelle agreement established with the International Research Laboratory (IRL) REHABS – a new research and training collaboration hub established between the CNRS (the French National Research Centre), the University of Lyon and Mandela University.

Prior to joining Nelson Mandela University, Dr Mgwebi was Deputy Vice-Chancellor: Research, Innovation and Engagement at Tshwane University of Technology, Director of Research at the University of the Western Cape (UWC) and Executive Director for Research Chairs and Centres of Excellence at the National Research Foundation.

Attesting to her leadership in the sector, Dr Mgwebi serves on several strategic science, innovation and higher education advisory and policy forums. She is the theme leader for the Council of Higher Education 25-year review of the South African higher education landscape.

The University's new Medical School offers us something unique in terms of creating a research hub in the medical sciences. To illustrate this uniqueness, in the words of the late Professor Lungile Pepeta, the leader in founding the Medical School, "People have been waiting for a medical school in Port Elizabeth since 1946. It's a giant boost for public health and the local economy. Our medical school will be the first in South Africa to use leading global technology for interactive anatomical education, radiology, surgery

"As Mandela University, we are committed to increasing and strengthening global connections, collaborations and contributions, particularly within our continent."

and research, such as the Anatomage virtual anatomy dissection tables, which feature the full external and internal anatomy of the male and female, with all the realism of living humans. The 3D body platform enables students to rotate the bio-digital human using their fingers trackpad-style, and the body can be 'cut' and operated on with the system's touch-interactive cutting tools. Our medical school programme is also unique in South Africa. It's a comprehensive approach to medicine that will focus equally on the four pillars of medicine – disease prevention, health promotion, treatment and rehabilitative medicine."

Through our Hubs of Convergence, Mandela University seeks to advance a distinct identity and academic reputation with a transdisciplinary focus to better respond to global sustainability challenges. The scale of these challenges, coupled with the wide-ranging impacts on social, environmental, and economic systems, requires solutions that can address the detrimental effects at a systemic level. This need for a new way of thinking about problem-solving has given rise to the relatively new discipline of sustainability science.

Sustainability science is an attempt to bridge the traditionally independent disciplines of the social and natural sciences, engineering, and medicine, to find creative solutions to the wicked problems posed by sustainability challenges. Nelson Mandela University is in a good place in this regard, and it is an opportune time to focus on this encompassing area across the research landscape at our institution.

Research Excellence Development Pipeline

Message from the Directors: Research and Innovation

By Dr Nomakwezi Mzilikazi, Dr Denise Schael and Dr Nqobile Gumede

The Research and Innovation Strategy approved by Senate in May 2019 is premised on the concept of a research excellence development pipeline which recognises that researchers at different stages of their career need different forms of customised support. It further recognises that strong infrastructures, systems, processes and a regulatory framework as well as adequate resourcing are critical for the successful implementation of the strategy.

Apart from resourcing, the successful implementation of the strategy is also dependent on a strong partnership, collaboration and co-ordination between the faculties in the Learning and Teaching portfolio and the Research, Innovation and Internationalisation portfolio. Some of the key strategic levers that will facilitate the

stimulation of research activity, productivity and vibrancy at the University have been identified as: postgraduate students, postdoctoral and research fellows and a well-supported and strong cohort of established researchers with networks on the African continent and across the rest of the world.

In 2019, working with the ICT department, we developed, tested and rolled out the Research Publication Management System, which allows individual researchers to upload details of their research outputs in preparation for submission to the Department of Higher Education and Training (DHET). This system allowed us to respond with agility when the COVID-19 pandemic and the associated lockdown precluded staff from accessing their offices on campus. Whilst a decline in research outputs was noted nationally, Mandela University research outputs showed an upward trend, with a total of 473.93 output units submitted for 2019, compared to 398.5 in 2015. This excludes the creative outputs that were successfully submitted for the first time in 2019. The DHET has in the past year shone the spotlight on research publication integrity and ethics, which calls for us as an institution to be alert and vigilant and ensure that we do not fall prey to questionable publication practices. We have made great strides with our Human Ethics Committee and remain fully accredited with the national body. We continue to facilitate ethical and humane research, and are developing an online ethics research management system to better serve the research community.

The numbers of postdoctoral fellows have also grown steadily, with 70 fellows in 2019, compared to 54 in 2016. The prestigious Vice-Chancellor's Postdoctoral Fellowships were launched with the aim of assisting the University to attract promising young scholars in support of four key strategic imperatives namely: revitalisation of humanities, support for institutional research themes, growing the African footprint and improving research productivity. We are continuously looking at mechanisms to fund postgraduate students at levels that will improve the chances of access, success and retention, as well as improving their research productivity and competitiveness. The Department of Research Support and Management has also strengthened its capacity to support the academy in the application for, and management of, external and international research grants. This will be increasingly important as



Dr Nomakwezi Mzilikazi

we navigate a post COVID-19 world, its associated implications and new opportunities.

The conversion of patents into commercialised products is one of the major indicators of successful innovation. The Innovation Office is particularly proud of the partnership with Prof Werner Olivier during 2019, which led to the conclusion of a licensing agreement with a private company and has resulted in the receipt of royalty income during the second quarter of 2020. There was also an increase in the number of intellectual property rights secured by the university during 2019. The University, through its commercialisation vehicles, continues to support entrepreneurship by both staff and students.

One such example is the support, through Propella, of the start-up company HedgeSA, which is founded by a multidisciplinary team of innovative graduates from Nelson Mandela University. Hedge SA teamed up to develop a low-cost bag mask ventilator called the Salutaris; Propella is currently supporting them and assisting with fund-raising and commercialisation of the bag ventilator to ensure that it is made available to hospitals and clinics during 2020. Innovolve, the University's other commercialisation vehicle, also initiated additional license agreement negotiations around two technologies during 2019, and these are envisaged to be concluded during 2020.

The University is highly appreciative of the innovation support received from the National Intellectual Property Management Office, and the Technology Innovation Agency during 2019, which enabled an increase in critical innovation capacity and technology development funding programmes at the university.



Dr Denise Schael



Dr Nqobile Gumede



"We are continuously looking at mechanisms to fund postgraduate students at levels that will improve the chances of access, success and retention, as well as improving their research productivity and competitiveness."

The Importance of Internationalisation for Research and Innovation

Dr Beata Mtyingizana, Senior Director: Mandela International Office

There has not been an experience, in our lifetime, that has so starkly laid bare the urgent need for the world to work together in knowledge production and dissemination as our experience of COVID-19. Not only has it unveiled the power that rests in the collective mobilisation of knowledge, resources and technologies, but it has also demonstrated the scale of the impact that the appropriate channelling of such power carries. Internationalisation, as both a conceptual tool and a process of collaboration, has become an important engine through which researchers, leaders and scholars across the globe can know of each other, learn about each other's work and identify opportunities for working together to come up with solutions to the world's problems.

Driven by its social justice praxis and by its stance as a university that is firmly in service of society, Nelson Mandela University produced and adopted an internationalisation strategy envisioned as optimising the impact of research in our society, in the African continent and the world. The commitment to emulating the values of South Africa's world-acclaimed struggle icon, Dr Nelson Mandela, places greater responsibility on Nelson Mandela University, as his



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Dr Beata Mtyingizana

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namesake, to engage in international partnerships that not only serve to optimise research, innovation and engagement but also to deliberately advance the requirements of a socially just society. This means that the internationalisation of higher education must be inherently transformative; it must be anchored in pursuits of

global research collaborations that focus just as sharply on social justice as they do on scientific discovery.

This is reflected in the wide-ranging nature of our international partnerships and collaborations across the world, as well as in our strategic priority of expanding collaborations in the African continent. The University is pursuing a dedicated programme of expanding its African footprint modelled against its commitment to honour the legacy and values of Nelson Mandela. It involves going back in time and strategically retracing Nelson Mandela’s very first journey outside the borders of South Africa, as he ventured into the rest of the continent to solicit support and mobilise resources for the liberation of his country.

By adopting a more comprehensive approach to internationalisation, Mandela University has embarked on an integrative approach to advancing research, innovation and engagement as well as supporting learning and teaching efforts across the system. It is an approach that enables the mutual reinforcement of efforts and gives elasticity to the benefits of research and innovation, thereby ensuring that research initiatives speak directly to the needs of society. This is important if we are to deliver on the national and global development imperatives envisioned in the United Nations’ Agenda 2030, in Africa’s blueprint for the transformation of the continent, *Agenda 2063: The Africa We Want* and in South Africa’s National Development Plan 2030.

Advancing a more comprehensive internationalisation strategy paves the way for greater connectedness, from the research field to the classroom, and thereby provides life-changing learning experiences to our students and academics alike. As it is, Nelson Mandela University is home to more than 1 000 international students from over 60 different countries as a result of such connectedness. The learning experiences of these students and the experience of conducting research and producing cutting-edge scientific discoveries at the University is located within an exciting period of institutional transformation. This has necessitated framing internationalisation efforts within the transformative goals of the institution, particularly in research and innovation collaborations. The research we embark on at Mandela University strives not only to challenge the conventional wisdom that frustrates development; it actually champions the exploration of epistemically diverse knowledge through interdisciplinarity. Nelson Mandela University encourages the application of different or new pedagogical techniques in research because this is key in redefining the boundaries of science and challenging those axiological and ontological perspectives that perpetuate injustice and inequality and undermine the values of ubuntu.

The Scholarship of Engagement

By Professor George de Lange, Director: Engagement Office

Nelson Mandela University foregrounds the scholarship of engagement by developing and cultivating an engaged, innovative scholarship which generates knowledge that is recognised for its contribution to sustainability: scholarship that is underpinned by a two-way flow of information and the co-creation of knowledge with community partners.

The scholarly outputs that flow from this are generated through a wide range of external collaborations and partnerships linked to the four categories that form part of our Engagement Conceptual Framework:

- Engagement through community interaction, service and outreach
- Engagement through learning and teaching
- Engagement through professional and discipline-based service provision
- Engagement through research.

In contrast to the more traditional academic research career paths, within the scholarship of engagement academics often do not conceive of their research programmes in accordance with

the “intellectual agenda” of a discipline. Engaged scholarship overcomes disciplinary boundaries; it assumes an interaction across disciplines and relevant sectors.

In this sense, a boundary-spanning scholarship is being created. Through their approaches to engaged scholarship, academics amplify their roles by making their intellectual outputs more widely available. By relating academic knowledge to its application, and producing new concepts and theories, by engaging directly with the challenges faced by society, they build and strengthen the relationship between the University and its community.

In some cases, the scholarship of engagement has resulted in the institution’s traditional boundaries requiring ongoing modification and innovation. Examples of this include the establishment of research and engagement entities, as well as the development of new policies and centralised support structures. These are constantly evolving, flexible and responsive, to allow for the building of interactive capabilities that orientate the University towards socio-economic responsiveness, inclusive development and service to society.

One of the results of our recent realignment process was the establishment of the Engagement and Transformation portfolio and the Research, Innovation and International portfolio, to further enable and support engaged scholarship. The structures within these portfolios support the emerging disciplinary culture that allows for creative research, learning and teaching to occur between disciplines. Engagement champions in all our faculties also contribute to the important development of knowledge networks with external partners.

Within the context of the University’s engagement realignment, a number of its integrated entities are well positioned to engage on societal issues with marginalised and vulnerable communities. Amongst others, they include the Centre for the Community School, the Centre for Integrated Post-School Education and Training, the Centre for Community Technologies, the Centre for the Advancement of Non-Racialism and Democracy, the Centre for Woman and Gender Studies, the institution’s Psychology Clinic, and the Chair for Youth Unemployment, Employability and Empowerment. These entities act as convenors, problem solvers and change agents, negotiating the wants and needs of stakeholders and the broader community involved in knowledge creation and dissemination.



Prof George de Lange

In terms of the University's financial sustainability, entities have the capacity to strengthen public financial support and leverage external funding, as the concept of engagement and engaged scholarship fits squarely with the priorities of donors and funding agencies.

As most of our faculty-based entities are self-funded, they have diversified external income streams which include the NRF, DST, TIA, the SETAs and the private sector. As a result, they have developed an entrepreneurial culture that is responsive to the needs of the specific communities they serve and provides innovative, cost-effective solutions to partners in business, industry and government. Their entrepreneurial endeavours include consultancy, laboratory testing services, contract research, short learning programmes, commercialisation of intellectual property and the creation of spin-off companies.

Included amongst the University's entrepreneurial entities are the Institute for Chemical Technology and Downstream Chemicals Technology Station (InnoVenton); the Centre for Law in Action; the Govan Mbeki Maths Development Unit; the Economic Development and Tourism Unit; the Advanced Mechatronic Training Centre and the innovation hub, eNtsa.

Several new entities are also emerging, such as Science Communication, Awareness and Advancement, in the Faculty of Science. Science communication opens the doors of knowledge, which are still closed to many, and it creates a scientifically literate community, able to engage in scientific research and science debates. Barriers to the use of scientific information in decision-making are overcome by fostering social capital among research collaborators – scientists, practitioners and community members –

“Through their approaches to engaged scholarship, academics amplify their roles by making their intellectual outputs more widely available.”

and through the recognition of local or indigenous knowledge and epistemologies. This is achieved by fostering relationships between these groups through collaborative research opportunities and engagement activities.

Institutionally, all these initiatives enhance the University's role and relevance in society, which is the cornerstone of engagement.

TRADITIONAL SCHOLARSHIP	ENGAGED SCHOLARSHIP
Breaks new ground in the discipline	Breaks new ground <i>and has a direct application to broader public and societal issues</i>
Answers significant questions in the discipline	Answers significant questions in the discipline <i>which have relevance to public and external communities</i>
Is reviewed and validated by qualified peers in the discipline	Is reviewed and validated by qualified peers in the discipline <i>and by members of the community</i>
Has a solid theoretical basis	Has a solid theoretical basis <i>and an applied basis</i>
Applies appropriate investigative methods	Applies appropriate investigative methods
Is disseminated mainly to academic audiences	Is disseminated to academic audiences and the broader community
Makes significant advances in knowledge and understanding of the discipline	Makes significant advances in knowledge and understanding of the discipline <i>and public and community needs</i>
	Applies the knowledge to address and provide solutions to community issues

Hubs of Convergence

Proposed by the Vice-Chancellor in 2018, and located within the Engagement and Transformation Portfolio, the Hubs of Convergence (HoC) endeavours to co-create physical spaces as platforms where the University meets its immediate communities to jointly find solutions to the problems that affect them.

“Convergence” relates directly to one of the key elements of the development trajectory of the University; it conveys the sense of people from all walks of life and backgrounds converging for a common purpose on an equal basis to help solve pressing societal issues.

The HoC presents exciting multiple opportunities for the institution to deliver on its broader operational mandates, while reimagining how to become truly engaged in responding to the complexities facing our world, starting with our immediate community.

The “newness” of the HoC means that the values and principles will continuously evolve alongside its practical implementation. The following, however, are the founding principles that guide our work:

1. The principle of convergence – the conscious effort of drawing together internal and external stakeholders to unlock the

knowledge and praxis that will enable all of us to better engage on broader issues that affect our society;

2. The principle of reciprocal solidarity – the practice of sincerely exchanging co-created knowledge and resources through generosity, solidarity, responsiveness, and inclusion, for the mutual benefit of all stakeholders;

3. The principle of multiple purposeful forms of engaged scholarship – recognising that socially engaged scholarship derives from an authentic process of learning with others in practice; that it embraces the uncertainty embedded in “not knowing”, and is supportive of multiple forms of knowledge to drive social inclusion and cohesion.

Originally conceptualised as multiple physical spaces of convergence, the HoC has repurposed itself as a central hub, with sub-nodes, in order to develop the necessary scholarship through practice and in collaboration with multiple stakeholders.

The process of the HoC conceptualisation is iterative, non-linear, messy, resource-intensive, and contested. Nevertheless, it is these processes that will help us better understand how to evolve into a transformative, engaged university, responsive to the societal challenges of the 21st century.



The development of a child's mathematical ability, language and literacy, self-concept and self-confidence, profoundly influences the rest of their life

Reimagining Schools in Our Communities

Centre for the Community School (CCS) in the Faculty of Education at Nelson Mandela University.

The impact of the COVID-19 pandemic has amplified the structural inequalities in our society and further exposed the country's two-tier education system. Even before the pandemic, 75% of our schools, predominantly those in socio-economically marginalised communities, did not deliver the same quality education as those in middle-class communities.

"We need to use this time of unprecedented disruption to move away from the notion of getting schools back to the way they were pre-pandemic, and to reimagine them as forming part of the broader social justice discourse and the critical need for redress in society," says Dr Bruce Damons, Director of the Centre for the Community School (CCS).

Over the past ten years, the CCS has been deeply engaged in understanding the key elements of a contextually responsive education system, and has been collaborating with a number of schools in the greater Nelson Mandela Bay and rural Eastern Cape to reconceptualise themselves as "community schools".

The community school is a school that is deeply part of its community in a community that is deeply part of the school. It is a space that is 'of' the community rather than 'in' the community. This approach to schooling requires engaging with schools, teachers, parents, community members, NGOs, CBOs, government departments and universities, to co-create solutions to current and future schooling challenges.

In 2019 the CCS was awarded a National Research Foundation grant to develop theoretical and practice-based models of school improvements that are relevant and responsive to the realities and socioeconomic issues of schools and the communities they serve. In 2019/2020 the centre produced and published *Reimagining our schools, strengthening our communities*, its first publication on the community school.

Dr Damons explains, "We need to foreground the knowledge of our communities and stakeholders in re-constructing the schooling space. Certain schools have triumphed over many years in spite of the severe socio-economic and other adversities they face. Their success relates to the strengths of the communities in which they are situated. These schools present an important opportunity

for us to understand the agency of the community school, which engenders a sense of ownership of the schools by the communities in which they are situated."

Rural school experiences

Since 2017, the CCS and the IKamvelihle Development Trust (IKDT) in Cala in the rural Eastern Cape has been piloting co-constructed school improvement plans with four schools, two high schools and two primary schools.

Numerous engagements have been held with principals, educators, parents and learners at the pilot schools, leading to the establishment of *Sakhingomso* (building a better tomorrow), a programme guided by five themes of collaboration, namely: teaching and learning support; psycho-social support; infrastructure; capacity building and community and stakeholder support. The participating groups identified contextually relevant school improvement projects under these themes for "scaffolded" implementation from 2018, based on priorities and available resources.

"Working with the rural schools in Willowvale, Mvezo and Qumbu is a fantastic learning experience as it challenges our notions of rurality. In these areas there is huge agency and willingness to engage and think through the challenges; the engagements are so enriching, and the CCS brings so much knowledge back to share with all our other communities of practice," says Dr Damons.

Success in the Metro

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. Charles Duna Primary in New Brighton is one of these partner Manyano schools. Led by Principal Nombulelo Sume since 1998, the school has 1 063 learners from Grade R to Grade 7.

Sume explains that many of the learners come from informal settlements where their lives are unspeakably hard; unemployment is rife, as are gangs, violence, single parent homes, orphans and HIV/AIDS.



The CCS in the Faculty of Education is committed to all children receiving a first-class educational start in life



"The power of dealing with our circumstances is in our hands, with education as the pinnacle." – Principal Nombulelo Sume, Charles Duna Primary, New Brighton

Despite this, over the past 15 years they have turned the school into a place of optimism, with 27 parent volunteers on site. It epitomises what the community school should be. The school has a well-managed library and reading clubs; they are also setting up two science labs for Grade 5 to 7 with funding they applied for from the Motsepe Foundation, as well as a computer lab for IT skills training and where community members can learn computer skills.

Community and NGOs

Community volunteers have supported the learners and their families throughout the pandemic and are an inspiration. Koleka Ndzuta, for example, started volunteering at Charles Duna in 2003 when her child was at the school. Ndzuta was unemployed at the time and received R500 from the government's Expanded Public Works Programme for her volunteering. She rose through the system and in 2011 was appointed as a Grade R teacher at Charles Duna and completed her ECD Level 4 and 5. She has since graduated with a BEd from Nelson Mandela University and is currently studying for her master's in educational psychology.

Community agency is complemented by external stakeholders and the important role they perform in the school and after-school space. One of these stakeholders is Masifunde, an NGO whose initiative, quaranTV – a self-produced TV show – brings content from core learning programmes to social media and to the local TV station, Bay TV. Episodes feature literacy, drama, music, visual arts, cooking, health and fitness, COVID awareness and prevention of domestic and gender-based violence.

Dr Damons concludes, "Responding to the pandemic presents us with an ideal opportunity to engage with all stakeholders around a model of school that can form part of a community response to other grand societal challenges. Our overall aim as the Faculty of Education and CCS is to participate in clarifying and defining what a quality public education system in South Africa should look like in service to society, and more specifically how we reimagine schools as beacons of hope and opportunity."



Dr Bruce Damons



Adapting for the Digital Now

The Centre for Community Technologies (CCT) in the Faculty of Engineering, the Built Environment and Technology (EBET).

The COVID-19 pandemic has fast-tracked digital transformation in all organisations, institutions and enterprises, as they have had to rapidly adapt and become more resilient. To prepare for this, people across all sectors need to acquire digital technology skills. More immediately, new technology is needed to overcome the challenges the pandemic poses to the country's health systems.

Nelson Mandela University's Centre for Community Technologies (CCT) is playing its part, both in providing immediate health-related technological solutions, and in longer-term digital skills development for the coming generation.

Professor Darelle van Greunen, CCT Director, outlines some of their efforts: "We are providing the ICT support for Nelson Mandela Bay's 3 500-bed Rev Dr EM Chabula-Nxiweni Field Hospital, which is the only paperless public sector hospital in the Bay. We also assisted with the development of a contact monitoring app for people who have been in contact with a COVID-19 positive person. The solution facilitates the capturing of comorbidities, which is one or more diseases or conditions that a person has, such as HIV, TB, diabetes and hypertension, in addition to COVID-19."

As part of the collaboration between the Office of the Premier and Nelson Mandela University, the CCT partnered the Eastern Cape Department of Education in developing an electronic screening tool that is interoperable with departmental information systems. The tool is web-based and has a preloaded database of the more than 5 000 schools in the province. Each principal has a unique login for their school in order to do daily COVID-19 screening of learners and educators. A risk profile of the household where the learners/educators reside is also created and used to assist in the identification of comorbidities and high risk clusters in the different communities.

In January 2020, Ncediso™, a complementary mobile application the CCT developed two years ago, received the United Nation's Innovation Award. Prof van Greunen explains, "The app upskills community healthcare workers in rural areas and townships where clinics and basic healthcare are scarce. It facilitates the early detection and management of chronic disease, and provides information on, for example, infectious and non-infectious diseases, and first aid."

In a whole range of ways, the COVID-19 pandemic has revealed the potential of what technology can offer, but at the same time there

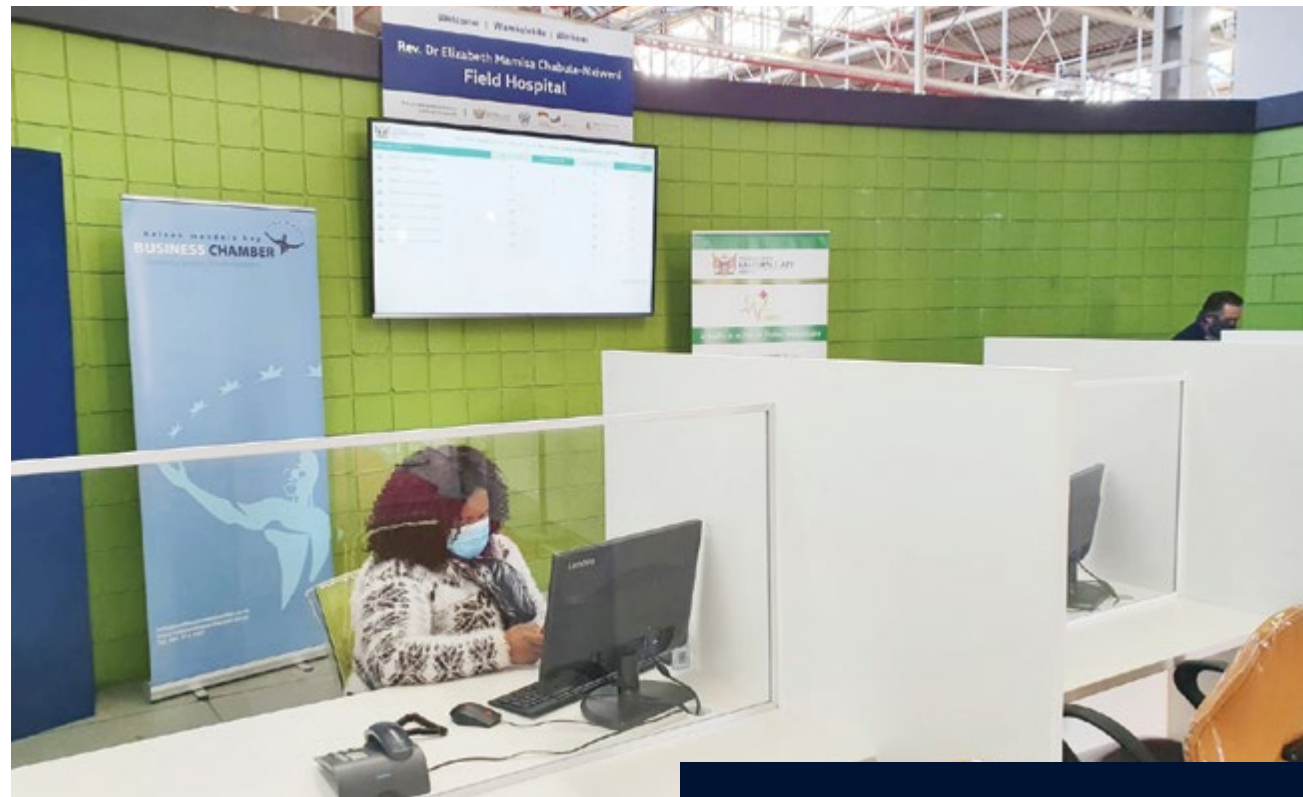
is a massive workforce in South Africa that is unprepared for this change. "A significant question is how do we engage and re-skill the workforce for the use of technology?" says Prof van Greunen.

"In the university space, we have to revisit the curriculum and ensure that there is a high degree of transdisciplinary learning, teaching, research, and engagement with society. Every academic programme across all faculties must have specific elements of being flexible, digital and data savvy, which includes communication methods, critical thinking, leadership skills, and emotional intelligence."

To provide a foundation, however, students must learn digital skills from primary school. The CCT creates innovative apps and support structures to assist learners with their studies. Their *Learn2Code* programme uses fun software coding techniques to teach primary



Prof Darelle van Greunen



3 500-bed Rev Dr EM Chabula-Nxiweni Field Hospital - the only paperless public sector hospital in Nelson Mandela Bay.
Photo: Prof Darelle van Greunen

school children in low income communities in the Nelson Mandela Bay Metro to do basic software coding, which develops their maths, IT and creativity abilities.

"But education can only be accessible to everyone if we enable access to education and learning through technology, and make it affordable," Prof van Greunen says.

She continues, "The necessity for 'eReadiness' and ICT capacity in schools has been emphasised for years, with pledges from Cabinet in 2013 to deliver free broadband access to 90% of the population by 2020 and 100% by 2030. This is yet to be achieved; meanwhile coronavirus has further highlighted the urgency for learners to be able to continue learning at home or wherever they are.

"Working in partnership with specific government directorates, we have developed the eReady ICT Maturity Assessment tool, a mobile app to assess and evaluate the eReadiness of all South Africa's public schools.

"The pilot is underway with some 3000 multi-grade schools in all nine provinces. South Africa has to rapidly and immediately change its education focus and delivery model to be ICT responsive and eReady," concludes Prof van Greunen.

Almost all sectors in South Africa have been severely impacted by COVID-19 and are forced to adapt the way they operate to survive.

"We are providing the ICT support for Nelson Mandela Bay's 3 500-bed Rev Dr EM Chabula-Nxiweni Field Hospital, which is the only paperless public sector hospital in the Bay."

For some, these changes are fairly easy while for others they are complicated and expensive.

The CCT is actively working with government departments, organisations and industry to develop innovative technology solutions that support some of the critical changes necessary to traverse the digital world.



All the Women's Voices

The Centre for Women and Gender Studies (CWGS) was launched at Nelson Mandela University in October 2019.

One of the CWGS's key academic projects is to research and foreground African women's biographies, intellectual production and political histories. These speak of women's power and leadership in society; absence and erasure of these voices is part of the sociology that contributes to gender-based violence (GBV).

"We see it as our mandate to resuscitate these voices and histories: not only the voices of intellectuals, we want all African women's voices – workers, rural women, women in business, politics, the arts..." says the Interim Director of the Centre, Dr Babalwa Magoqwana.

The CWGS is mainstreaming these histories in its teaching and research:

- To develop a gender corridor in the Eastern Cape
- To link universities and scholars dealing with gender questions and who profile African women's biographical intellectual histories.

"We are partnering with other universities in the Eastern Cape, such as Rhodes University, in talking about women's liberation histories and popularism; how women in the liberation struggle were more than mothers and wives – they were essential to the revolution," Dr Magoqwana explains.

"We shouldn't be reading about Sol Plaatje and the history of the ANC without reading about Charlotte Maxeke. In the same vein, we have commissioned a thesis on Adelaide Tambo who is often referred to as the wife of Oliver Tambo although she was a political force in her own right. This is the kind of erasure of African women's intellectual history we are combatting. Even in the rewriting of our country's history, our African brothers have generally neglected the enormous role of women; or referred to them as 'the wife' or 'first lady'."

The CWGS is currently working on a book on African women's intellectual histories co-edited with Rhodes University's Dr Siphokazi Magadla and Athambile Masola from the University of Pretoria. Due for publication in 2021, the book explores the voices of women in all spheres – from pop icon and activist Brenda Fassie in the eighties and nineties to intellectual activist Charlotte Maxeke, going back 150 years.

The CWGS is also exploring what it means to be "Queer in Africa", based on the work of Professor Zethu Matebeni, the Centre's



Dr Babalwa Magoqwana

first visiting professor, appointed in 2019, who is based in the Department of Anthropology and Sociology at the University of the Western Cape. Her research focuses on gender and sexuality, with specific attention on black lesbian lives, LGBTQ rights and queer issues.

"To show that LGBTQ life is not foreign or Western, it is part and parcel of our own cultures, Prof Matebeni explores the local languages in the Eastern Cape and how they represent sexuality. Her research speaks directly to what is happening in our own communities and to the growing conservatism about sexuality in Africa that is often based on religiosity. It challenges dogmatic and traditionalistic approaches that dismiss sexuality as something that should not be engaged with in an African context."

Prof Matebeni's films, poetry and essays have been published in numerous journals and she is the co-editor of *Beyond the*

Mountain: Queer Life in Africa's Gay Capital (UNISA Press, 2019), and *Queer in Africa: LGBTQI identities, citizenship and activism* (Routledge 2018).

In response to the COVID-19 pandemic and rise in GBV during lockdown, the CWGS launched a digital platform in early April 2020 to build a local and global online community. "We invite people to speak on the work they have published and we encourage students from different disciplines and faculties to participate," says Dr Magoqwana.

As part of their aim to develop perspectives on the effects of the COVID-19 crisis, the CWGS's weekly online series *Reading with the author* began with a focus on health and gender, in a conversation titled "COVID-19: Movement and class in post-apartheid South Africa" by gender activist and prominent feminist author, Professor Pumla Gqola.

"The CWGS is committed to addressing issues to which everyone can relate," says Dr Magoqwana. "In the Department of Sociology



Award-winning Port Elizabeth-based Afro-Jazz singer, Asanda Mqiki, performs at a public lecture on Women and Leadership in Africa.

we will be investing in a new curriculum that foregrounds African sociology, to nurture African-centred gender scholars from first year who can see themselves in the curriculum and go on to pursue master's and PhD degrees."



The Centre for Women and Gender Studies in partnership with the Vice-Chancellor's Office and African women leaders' platform, Vokal, invited former Malawian president, Dr Joyce Banda to deliver a public lecture on Women and Leadership in Africa on 29 February 2020.

GBV during lockdown

GBV has escalated during the COVID-19 lockdown. While our country is working hard on controlling the virus, very little has happened to control GBV. Nelson Mandela University has responded by establishing the GBV Command Centre for anyone in need of help in the Nelson Mandela Bay Metro. The call centre number is 0800 428 428 and 0800 120 7867. The University also launched the MEMEZA anti-GBV campaign, which raises awareness about GBV and seeks to improve community safety through the distribution of yellow whistles, to be blown in an emergency.

Chair for Critical Studies in Higher Education Transformation (CriSHET)

As part of the current debates about the decolonisation of the University, CriSHET's purpose is to drive the transformation agenda by grounding it in critical studies and framing it within the concept of an African-purposed curriculum. This includes being a strategic resource to various key stakeholders internally and externally and supporting the leadership team, positioning Nelson Mandela University to make strategic impact within the higher education sector. CriSHET thus works closely with the other entities in the Engagement and Transformation Portfolio, and has provided support to the Hubs of Convergence, the Transdisciplinary Institute for Mandela Studies, and the Centre for Women and Gender Studies.



Prof André Keet

Since its launch in 2018, CriSHET has made great strides in working towards its vision of being a premier national, regional and international site for critical studies and praxes in higher education transformation. It hosts a long-running seminar series entitled *[Re] Directions/Ukutshintshwa Kwendlela: Knowledge, Praxes and the African-Purposed Curriculum* and has also co-hosted a number of public lectures by scholars of decolonisation.

Central to CriSHET's work has been the development of Critical University Studies and other alternative, radical approaches to studying the university. In 2019, in collaboration with Queen's University, Belfast, CriSHET hosted a Winter School on the theme *Emancipatory Imaginations: Advancing Critical University Studies*.

This school brought together scholars and practitioners from South Africa and countries such as Ghana, Kenya, Uganda, India, the UK and Ireland. The result has been an extensive and productive network of scholars, who have come together most recently to discuss the impact of COVID-19 on the study of the university. CriSHET also supports a growing cohort of postgraduate researchers and two NRF-funded Critical University Studies projects.

Other recent notable activities have been Prof André Keet's presentation on "Racism's Knowledge, Critical Hope and the Transformation of the University" in the webinar *The Contribution of Universities to Racial Justice*, co-hosted by the Society for Research in Higher Education, South West Network, the International Centre for Higher Education Management (University of Bath), and CriSHET; and the publication of the first volume in the On Higher Education Transformation book series, co-edited by Prof Keet and Prof Michael Cross, entitled *Scholarly Engagement and Decolonisation: Views from South Africa, The Netherlands and the United States*.

"CriSHET's purpose is to drive the transformation agenda by grounding it in critical studies and framing it within the concept of an African-purposed curriculum."



Transdisciplinary Institute for Mandela Studies (TIMS)

The envisioned Transdisciplinary Institute for Mandela Studies (TIMS) is anchored in an institutional partnership between Nelson Mandela University and the Nelson Mandela Foundation (NMF). The University and NMF are both cognisant of the great responsibility associated with bearing the name of Nelson Mandela. It is our duty to foster the intertwined legacy and memory of Madiba, but simultaneously to recognise that it is not a static inheritance and if we are to engage critically with that legacy, we should move beyond the man to the multiplicity of the social figure of Mandela.

Interestingly, Mandela understood that his legacy could not simply be preserved through the ages. In an interview with John Battersby of the *Christian Science Monitor* in February 2000, a decade after his release from prison, Madiba contemplated this legacy: "Whatever my wishes might be, I cannot bind future generations to remember me in the particular way I would like". His words reveal an understanding of memory as a living legacy to be mobilised and utilised by future generations.

TIMS is steadily developing, with several legal documents in place to foster the institutional partnership between the University and the NMF. This partnership is consolidated by a Memorandum

of Understanding (MoU) that was finalised by Nelson Mandela University Vice-Chancellor, Professor Sibongile Muthwa, and the Nelson Mandela Foundation Chief Executive, Mr Sello Hatang, at a signing ceremony on 3 February 2020.

The MoU defines the basis for collaboration between the University and the NMF in the areas of social justice advocacy, scholarship and research, as well as human rights-related projects. It was preceded by a Project Agreement between the parties, effective from 1 September 2019, in order to deliver on key performance areas, such as advancing scholarship on Mandela, as well as contributing to the conceptualisation and establishment of an academic vehicle for Mandela Studies. National and international collaborators, Professor Verne Harris from the NMF and Professor Xolela Mangcu from George Washington University, are providing essential input to advance TIMS.

On 9 July 2020, the Chair for Critical Studies in Higher Education Transformation (CrSHET), in partnership with the NMF, hosted an international webinar on "(Re)Assessing Mandela". The purpose of the webinar was to engage with current Mandela-related scholarship, identify and explore fresh lines of enquiry, and distil critical questions that would be helpful for the current process towards the establishment of TIMS.

Engaged Science

Engagement is a core focus of the Faculty of Science's vision to be an engaged, dynamic African faculty of science. The use of the overarching term 'engaged science' includes all aspects of public engagement with science: science communication; science literacy; and science outreach and awareness. In addition, it focuses on South African, continental and international partnerships with higher education institutions, research and training facilities, and industry.

In 2019 Senate approved the establishment of a Faculty of Science Engagement Committee. It is the first of its kind at a faculty level in the University. Other faculties, and the University as a whole, have Research and Engagement Committees, but the Faculty of Science, led by Professor Azwinndini Muronga, saw fit to separate them. The rationale is that the Faculty of Science is research intensive and therefore if Engagement is bundled with Research, then Engagement will suffer. The Faculty is also significantly expanding its engagement activities, which warrants a standalone committee.

As part of the Faculty's organisational redesign, the Science Engagement Strategy framework provides an overarching structure for advancing science promotion and engagement locally and internationally, in pursuit of a society that understands and values science and technology and its critical role in national prosperity and sustainable development.

In this context, the Science Engagement Strategy embraces a broad understanding of 'science' and 'the sciences', encompassing systematic knowledge that spans the natural and physical sciences, engineering sciences, medical sciences, agricultural sciences, mathematics, social sciences and humanities, technology, all aspects of the innovation chain, and indigenous knowledge.

Through this integration, the faculty aims to foster better, more valuable science engagement.

At the core of the strategy are four major aims, under which several interventions or initiatives are outlined.

1. To popularise science, engineering, technology and innovation (STEMI) as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers. To attract and retain students in STEMI disciplines along the full length of the educational pipeline.
2. To develop a critical public that actively engages and participates in the national discourse of science and technology to the benefit of society.
3. To promote science communication and enhance science engagement in South Africa.
4. To profile the Faculty of Science, its science and science achievements nationally and internationally, demonstrating our contribution to national development and global science, thereby enhancing our academic and public standing.

Industry Engagement in Crude Oil-based Fuel & Minerals Processing

Most of our energy will still come from fossil fuels for some time to come, so we need to engage with industry to reduce the harmful substances in crude oil as much as possible by developing novel technologies.

Global energy demand, especially for transportation fuels, keeps rising, and the world energy demand by the year 2050 is projected to be two to five times higher than at present. "Most of our energy still comes from fossil fuels and while we are starting to see slow growth in renewables, there is not nearly the capacity required, and nuclear is flat in terms of growth," explains the Department of Chemistry's Professor Zenixole Tshentu.

"Even though we should be getting away from crude oil-based energy because of its carbon footprint and the harm to the environment, most economies are still driven by it. Hence, when the fuel price shifts, the rand to dollar and euro rate shifts."

Most motor fuels are derived from oil, as Prof Tshentu explains: "Most crude oil tends to be of a heavier and sourer composition, that is, with higher organosulfur and organonitrogen compounds, which is undesirable, as sulfur dioxide (SO₂) can result in acid rain, is harmful to the environment and contributes to global warming. Sasol blends it with cleaner fuel from gas to reduce the sulfur but the technology doesn't yet exist to reduce the sulfur content of crude oil."

Reducing deleterious substances in fuel oil

This year, Prof Tshentu and Dr Adeniyi Sunday Ogunlaja, also from the Department of Chemistry, are working with Dr Ryan S. Walmsley from Sasol Technology Pty Ltd on a project to reduce the harmful substances in crude oil-based fuel, titled "Oxidative- and hydro-desulfurisation and denitrogenation of fuels".

"We proposed oxidising the molecules and then removing them by solvent extraction, but this requires two additional units in the refinery process, with significant extra expense," says Prof Tshentu. "So the idea now is to go back to the hydro-desulfurisation process to see if we can develop new and better catalysts. We cannot use base metals – they cannot get the sulfur down to the legislative level – so we are looking at platinum group metals. Our metal of choice is rhodium, as it's a good reduction catalyst, and then coupling it with a base metal to make the final catalyst less expensive."



Prof Zenixole Tshentu

"One of our MSc students, Siphumelele Majodina, is in the final stages of the preliminary tests on this in our department's high pressure reaction system. We have some results, but they are not conclusive and need to be tested at Sasol's more advanced reactors. We would currently be testing it at Sasol if it wasn't for the COVID-19 lockdown."

"In addition to this part of the research, we are looking at nitrogen, which is also not good for the environment and damages the catalyst that converts the sulfur, so it brings two problems. We have proposed a system of denitrogenation of fuel oil that Dr Mohamed



"Even though we should be getting away from crude oil-based energy because of its carbon footprint and the harm to the environment, most economies are still driven by it."

Abdul-Quadir, who completed his doctoral research in 2019, has been working on. We are grateful for the analytical facilities that were made available at Sasol for this project."

Minerals to metals

The second industry project the department is working on is "Resin development for separation of iridium from rhodium", in collaboration with Sibanye-Stillwater and the South African Minerals to Metals Research Institute (SAMMRI). Prof Tshentu is the principal investigator and the co-investigator is Dr Avela Majavu, research and development chemist at Sibanye-Stillwater.

Innovation funding for the mining industry was provided by the Department of Science and Innovation (DSI) and administered by SAMMRI. "Some mining companies are considering adopting newer technologies that have greater processing capacity and are more specific for metals of interest, in this case platinum group metals," Prof Tshentu explains.

"As partners in the project we are going to produce a 100 gram resin to test on some model solutions in our lab and then at Sibanye-Stillwater. We have started on the separation of iridium from rhodium technology based on the research of one of our 2019 PhD students, Puleng Moleko-Boyce, but we will only know the actual performance once we have gone through the full process on a larger scale. One of our master's students, Zizipho Ngayeka, will apply it to the industry-specific process once we can operate again. Dr Majavu will oversee the industry testing aspect of the chemistry we have developed. The COVID-19 period has been a very frustrating time for our students as they wanted to get on with their research."



Farewell Maarten

The Africa Earth Observatory Network (AEON) pays tribute to its Founding Director, Professor Maarten de Wit. 9 Jan 1947 – 15 Apr 2020

A remarkable contribution to our past, present and future

Professor Maarten de Wit – Maarten to all, including his students – was an A1-rated National Research Foundation (NRF) scientist, recognised nationally and internationally for his groundbreaking research projects.

Maarten first came to South Africa to study the Makhonjwa Mountains in Barberton, which preserve some of the oldest and most complex rocks on Earth, and became passionate about learning from their ancient stories, and in particular how life first started, and how to use cutting-edge science experiments to discover as much as possible.

In 2006 he founded the African Earth Observatory Network (AEON) with scientists from South African, Australian and UK universities. His vast scientific interests encompassed African geology, eco-dynamics, economics, sustainability of natural resources, intergenerational equity, and transformation in agriculture linked to science and technology. He also planted the seeds of a new ocean sciences initiative at Nelson Mandela University, asserting that a

university by the sea without ocean sciences is an oxymoron.

Maarten was not simply satisfied with a deep understanding of the planet, but understood implicitly the crisis confronting the Earth. He recognised that solutions for the future could not be found in the antiquated thinking locked within the disciplinary confines of traditional science. Instead, he advanced the transdisciplinary science of Earth Stewardship, which sought to build an integrated approach to investigating the impacts of geological, biological, social and cultural processes. Maarten championed this through his commitment to social engagement and collaboration and ultimately established the first NRF-funded programme for Earth Stewardship Science, focused on research and the training of young scientists in Africa.

Today AEON graduates are worldwide; in academia, government, civil society and industry, making their contributions towards preserving and rebuilding our collective Commons. Maarten was emphatic that whilst this was the task of scientists, scholars and thinkers in the academy, it meant nothing without the voices and agency of ordinary people, their hopes, their fears and their aspirations for the future. He believed that the world yet to come belonged to all who occupied it: that all had a stake in its future, not just scientists, politicians or the wealthy.



Prof Maarten de Wit



Master's in Engineering student Michelle Ngugi won first prize for the best presentation for her paper at the 2019 African Laser Centre (ALC) Conference in Stellenbosch

4IR and Big Data Communication for Africa

Building the backbone and infrastructure for big data science and advanced communication networks for Africa is the CBC's domain.

The Centre for Broadband Communication (CBC) is involved in a number of 4IR research projects, including advanced communication networks and big data science applications for 5G, Artificial Intelligence (AI), undersea robots, the world's biggest telescopes and early warning geological sensors to detect earthquakes and ground tremors.

Professor Tim Gibbon, Director of the CBC explains, "Our research and engagement is focused on creating machine learning and AI solutions (both hardware and software devices) to real world problems, including how to make the Internet faster; generating big data science technologies for the biggest science projects on the African continent, notably the SKA, MeerKAT and HIRAX; and creating optical fibre sensors for geological applications such as earthquake and dam wall collapse detection.

"In all our work, we engage with industry and government in addressing advanced technology needs or problems they want

solved. They, in turn, provide extensive funding and grants in exchange for solutions, IP, technical deliverables and human capacity development. The funding is used to grow the CBC Lab and research, to purchase research equipment, for postgraduate student bursaries, and for the students and CBC team to participate in local and international conferences."

Growing Africa's scientific "new timber" is key for the CBC. Postdoc Dr Shukre Wassan did his master's and PhD with Prof Gibbon and is today an invaluable CBC team leader, an outstanding scientist and an expert on timing distribution networks and sensors.

Three of the CBC's main university collaborators are: the City University of London, the National University of Science and Technology in Zimbabwe and the University of Eldoret in Kenya. Graduates from the CBC go back to their own countries to lead research there.

Prof Gibbon is the project leader for the African Laser Centre (ALC) project to foster laser-based telecommunications research on the continent, for which he received a grant of R250 000 from the CSIR in 2019. This facilitated the hosting of African students and



Postgraduate students and researchers in the newly renovated Commons. The space is designed to foster collaboration between physics and other disciplines. Standing, left to right: James Jena, Len Compton (Mechanical Workshop), Phumla Dlamini, Reinhard Karembera, Ketshabile Nfanyana, Dr Lucian Bezuidenhout (AEON). Seated, left to right: Dr Shukree Wassin, Prof Tim Gibbon, Michelle Ngugi (Engineering)

researchers at the CBC Lab – providing them with access to equipment and expertise not available in their home countries. The grant covered the full travel, accommodation and S&Ts for the following researchers:

- Dr Valentine Chabata, Zimbabwe, lead researcher
- Dr Duncan Boiyo, Kenya, lead researcher
- Douglas Osiemo, Kenya, PhD student.

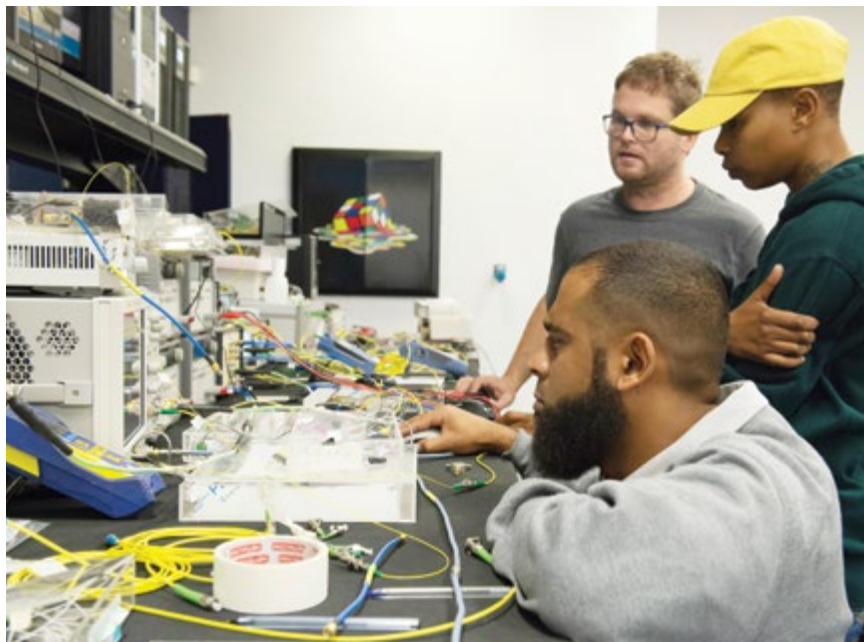
“Our CBC group is transdisciplinary by nature and at Nelson Mandela University we work with the Africa Earth Observatory Network–Earth Stewardship Research Institute, known as AEON–ESRI, and the Department of Computer Science in the Faculty of Engineering.”

A small, high-powered group, in 2019 the CBC had four master's students, four PhDs and two postdoctoral researchers. In addition to attending local and international conferences, in 2019 the CBC published 18 articles in accredited journals.

In 2019 the CBC's many research engagements included:

- Research and Development of fibre-to-the-hut (FTTH) technologies: low cost broadband solutions for Africa, developed for Telkom, Ingoma Communication Services and Dartcom.

- Coherent Communication for 5G and Timing Networks for the CSIR National Laser Centre (NLC) through a R1-million grant used for the purchase of equipment.
- Research and planning of communications systems and co-development with eNtsa of an application for undersea drones and robotics for the new Marine Robotics Unit at Nelson Mandela University. The underwater communication subsystem will be activated in 2020.
- Researching Distributed Optical Fibre sensors for Geological Applications for AEON's Professor Moctar Doucouré and Doctor Bastien Linol. A collaboration, started in 2019, to grow geophysics through researching optical fibre-based seismology sensors.
- Technology for mining for DSI, DMR. This is a new area of research being set up with relevant partners. The goal



Dr Shukree Wassin (kneeling), Prof Tim Gibbon & PhD student Phumla Dlamini in the CBC lab experimentally testing a frequency reference distribution design. The lab is the most advanced of its kind in Southern Africa

is to research 5G, Sensing and Machine Learning technologies specifically for the benefit of the mining sector.

- Assisting in the research, development and testing of the HIRAX telescope data aggregation links for the University of KwaZulu-Natal, McGill University and SARAO, who are leading this project. The main array will be located near the SKA telescope in the Karoo, and will have important synergies with MeerKAT and the SKA. HIRAX's goal is to determine the characteristics of dark energy between seven and 11 billion years ago.



Prof Paul Watts

Coronavirus Highlights Need to Manufacture our Own Drugs

The current coronavirus pandemic has once again highlighted the need for South Africa to manufacture its own life-saving drugs.

The global response to the COVID-19 pandemic has exposed the weaknesses in the supply chains for vital medicines and their components. Much of the world's supply of raw materials for drug manufacture comes from China, the country first massively affected by the pandemic. As a result many drug ingredient makers in China remain shut or have reduced their output, cutting at the foundations of worldwide pharmaceutical supplies.

Fortunately, South African government policy has, for some time, encouraged the development of generic replacements for imported pharmaceuticals, a challenge taken up by Professor Paul Watts, SARCHI Chair in Microfluidic Bio-Chemical Processing at Nelson Mandela University, and his team.

“We have done a huge amount of research into new ways of manufacturing generic life-saving medications in South Africa, specifically for AIDS, TB, malaria, cancer, diabetes and influenza,” says Prof Watts.

“However, none of the active pharmaceutical ingredients (APIs) for HIV, TB and malaria medications are currently made locally, which makes them incredibly expensive, and, with the advent of the coronavirus there is expected to be a significant decrease in supply.

“Surely this is a clear indicator that we must start to manufacture quality products in Africa, for Africa, at a lower cost,” says Prof Watts, who has a doctorate in bio-organic natural product chemistry.

It has taken him and his team 20 years to develop the necessary technology to enable the manufacture of the APIs in South Africa, and also to make them 20% to 30% cheaper.

In any tablet, whether an aspirin or ARV medication, about 70% of the cost is the drug substance – the API – which is the principal component. The other 30% is for the excipients, the substances that help deliver the medication to your system.

Over the past 10 years, South Africa has spent around R120-billion buying in APIs from India, and even more on purchasing from China. Add to this the cost of formulating these APIs into tablets, and you get some idea of the total cost. And because of these costs, there's simply not enough to meet the huge demand for medications.

The local manufacture of key generic drugs for major diseases in South Africa and Africa could ensure that more people have access to the drugs, it could save billions, create jobs and establish a new manufacturing industry. Local manufacture would also mean the quality of the APIs is assured, which is currently not the case in all countries in Africa.

Prof Watts explains they have got to the point where, for example, three different AIDS drugs have been manufactured at lab scale on campus and they are now pursuing intellectual property protection in South Africa and other major pharmaceutical manufacturing nations. Several of the patents have already been registered.

"These are known generic drugs, we have not developed a new drug; we have developed a new way of more efficiently manufacturing the drug," explains Prof Watts. "We can also

manufacture drugs under patent, but we would need a licence for the patent – this would not be cheap, hence our initial focus is on generic drugs not under patent."

The microfluidic bio-chemical flow process or "flow chemistry" used to create the drugs starts with a microreactor about the size of a mobile phone. Built into the microreactor are a series of channels that the chemicals pass through. The National Research Foundation National Equipment Programme contributed R2.2-million for the flow reactor required to create the drugs. This represents two-thirds of the funding necessary, with Nelson Mandela University contributing the remaining third.

The University is developing partnerships with South African companies with the aim of establishing the manufacturing plant and is currently awaiting approval for further funding from government. All the equipment would come from Europe and be approved for drug manufacturing purposes. "We'd probably have one centre in South Africa where the drugs would be manufactured, and it would make sense for it to be near a port for export and procurement of raw materials," says Prof Watts.

Despite all protocols being met, there are endless delays over the funding, which is highly frustrating for the researchers. But perhaps the coronavirus crisis will persuade government or industry to urgently invest in drug manufacturing on home soil. Prof Watts concludes, "We are so close to doing something big here. We will keep on with it until it happens."



The KiloFlow flow reactor required to create the drugs

Ocean Sciences

Nelson Mandela University is positioning itself as the hub for ocean sciences in Africa and the Western Indian Ocean. As a coastal university we partner with the national and international marine and maritime research community, including the UK, Norway and France.

In March 2019, the University hosted the first of two pivotal ocean sciences conferences. Held for the first time in Africa, the Second International Indian Ocean Expedition (IIOE2) brought together partners from all the major ocean sciences nations in the single largest transdisciplinary effort to advance understanding of the Indian Ocean and enable informed decision-making.

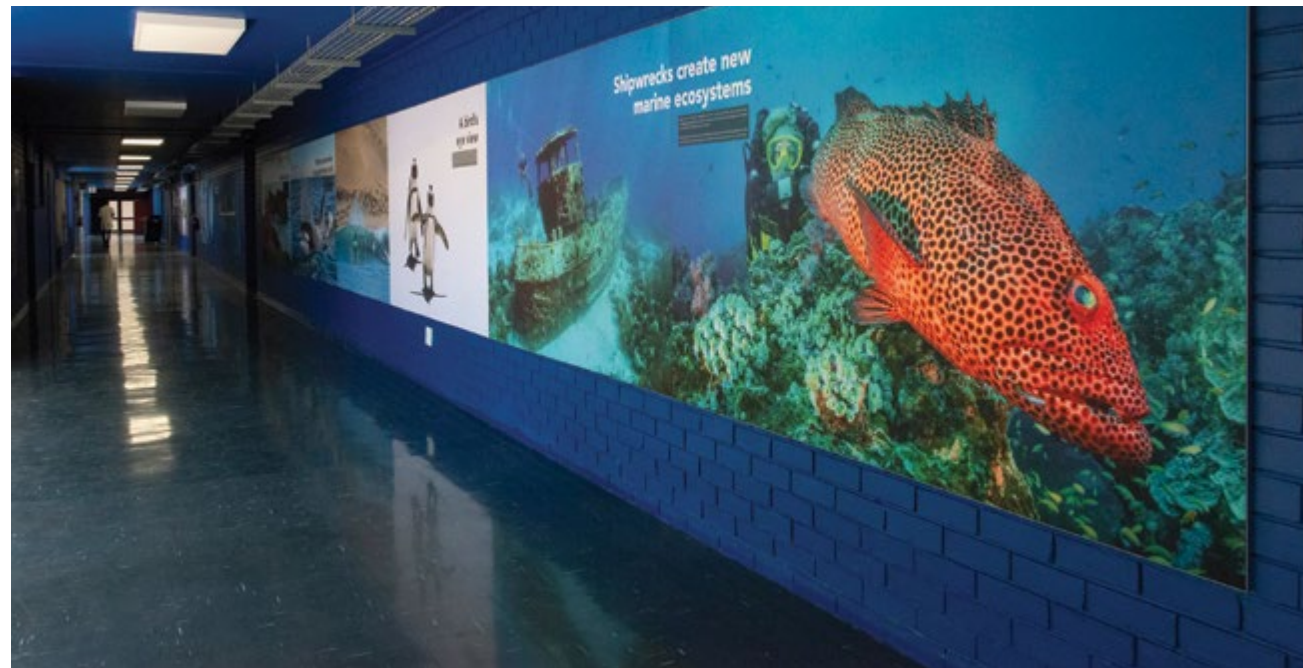
The second major ocean science conference we hosted was Sanocean, the South Africa-Norway Research Co-operation on Blue Economy, Climate Change, the Environment and Sustainable Energy. The long-term programmes in this partnership enhance the knowledge base for policies and decisions for sustainable development in these focus areas.

To further the University's role as a maritime hub, our faculties and dedicated Ocean Sciences Campus (the first of its kind in

South Africa) offer a range of qualifications and programmes that support ocean sciences research and development, conservation and a sustainable, well managed blue economy. As part of this multifaceted offering, for example, the Faculty of Engineering, Built Environment and Technology offers a marine engineering degree, and in 2019 it launched a pioneering Marine Robotics Unit.

The Faculty of Law's FishFORCE programme, which works with international partners in South Africa and the Western Indian Ocean region, is recognised as a world leader in the training of fisheries law enforcement agencies and in research and advocacy aimed at combating organised crime in the fisheries environment.

We welcome the United Nations Decade of Ocean Science for Sustainable Development from 2021 to 2030. As science research, policy and practice engage, the decade will become the largest driver ever to protect the oceans, address ocean warming, and use the space sustainably. With South Africa's 3 000km coastline bordering three oceans – the Atlantic, Southern and Indian – we are perfectly placed to contribute to and benefit from this much-anticipated "blue decade".



Nelson Mandela University, Ocean Sciences Campus

Novel Research on Seamounts for MADRidge Project

The seamounts around Madagascar are marine biodiversity hotspots and yet very little was known about them, putting them at great risk of damaging exploitation.

A major research project called MADRidge, completed in 2019/20, focused on three submarine seamounts around Madagascar in the Western Indian Ocean (WIO) to begin to understand these biodiversity hotspots.

“Seamounts, with their special shape and depth, are biodiversity hotspots, attracting top predators such as tuna, billfish and sharks near their summits,” says marine specialist scientist Professor Mike Roberts, who heads the South African Research Chairs Initiative in Ocean Science and Marine Food Security. MADRidge is one of six major research initiatives that Prof Roberts is rolling out in the WIO.

The Chair is jointly hosted by Nelson Mandela University in Port Elizabeth, the University of Southampton and the Southampton-based National Oceanography Centre – the United Kingdom’s leading marine science research and technology institutions.

The Chair is also partnering leading French marine research institutions, notably the Institut de Recherche pour le Développement in Marseille and the Université de Bretagne Occidentale in Brest. MADRidge is part of this partnership.

“Seamounts, which are essentially reef systems, are exceedingly important for marine food security as the vertical movement of deeper, nutrient-rich water against the abrupt topography induces regular upwelling which stimulates primary production in the upper layer of the ocean,” says Prof Roberts.

Based on these considerations, an international team of scientists from France and South Africa, undertook three research cruises, one to each of the most prolific seamounts in this region – MADRidge (240m below the surface), Walters Shoal (18m below the surface) and La Pérouse (60m below the surface).

“Understanding one of the least known marine hotspots in the world required an intensive multidisciplinary team effort that has built and strengthened the network between the partnering institutions in France, South Africa, the UK and Madagascar.

The research is being used to involve international bodies in trying to protect the fisheries around the seamounts, which are in the open ocean and classified as Areas Beyond National Jurisdiction. Because no one is policing, these fisheries have been plundered since the 1970s by European, Russian and Asian fleets, and since the 1990s by others operating out of Réunion.

The slow growth, late maturity and low fecundity of many of the deep-sea species fished here contributes to their decimation.

Added to this is the emerging threat of mining. These threats have raised a number of questions, such as the legal status of seamounts – both within and beyond national jurisdiction – which laws apply, and who will implement the legislation at these faraway isolated sites. This brings into focus important bodies like the International Seabed Authority.

Marine Food Security

The Western Indian Ocean (WIO) region, extending up the eastern coast of Africa, has the most serious food security problem on the planet. It is estimated that 60 million people in the region directly depend on the ocean for their livelihoods, at a time when the indications are that the WIO is warming faster than the world’s other oceans, impacting all levels of the marine food web. Overfishing, destructive fishing practices and high levels of pollution are causing the WIO marine environment to deteriorate further. What is Africa doing to address this? “We are pursuing intensive research to understand and address the key questions of what sustains marine food security, what the underpinning ecosystems are and how do they function in this era of climate change and changing global oceans,” says Prof Roberts.

The multidisciplinary nature of the MADRidge project, combined with the research cruises, provides an excellent setting to develop early career researchers and postgraduate students – especially for those from South Africa and the WIO who do not have access to world-class research infrastructure and technologies. The team approach with senior scientists has not only provided mentorship, but strongly assisted them in publishing their first results.

The extensive MADRidge research is being published in August 2020 as 13 articles in a special issue of the international journal, *Deep Sea Research*, titled *Bio-Physical coupling around three shallow seamounts in the South Western Indian Ocean, with regional comparisons based on modelling, remote sensing and observational studies*.



Prof Mike Roberts

Marine Robotics Unit

Prof Roberts’ research and innovation bridge has also led to the establishment of the Marine Robotics Unit (MRU), which was launched at Nelson Mandela University in 2019 during the international IIOE2 conference. The MRU’s engineering team, headed by Akshay Lakhani, has designed an ocean glider that features novel technologies, to be built by the end of 2020. The team is also building an ocean drone to replace the use of an inshore research vessel. The drone carries sensors that are dipped into the sea to measure water temperature, salinity and fluorescence. It is also used to calibrate satellite data. This machine can cover 100km at sea, hover and collect the same information as the ocean glider.

The Chair recently received a UVP photo-imaging camera from the French partners that gives real-time marine data in pictures. “We were hoping to use it on a research cruise in July 2020 for a study in the northern Agulhas current, but COVID-19 has delayed this,” says Prof Roberts.



ADCP (Acoustic Doppler Current profiler) mooring being deployed at MADRidge to collect data on ocean currents, temperature and salinity. Photo courtesy Prof Mike Roberts



Senior research scientist Dr Margaux Noyon in the bio lab on the RV Antea

Global South – Global North Research Bridge

Because Africa does not have the resources to finance research vessels and advanced marine technology, the Chair has developed the Innovation Bridge–Regional Hub approach. This builds strong, formal partnerships between top institutions in Africa and top, well-resourced institutions in the Global North. “Through this alliance,” Prof Roberts explains, “we can increase southern hemisphere research capacity to tackle developmental and ocean science issues that are equally challenging for northern institutions, as the Indian Ocean is the least researched and understood in the world.”

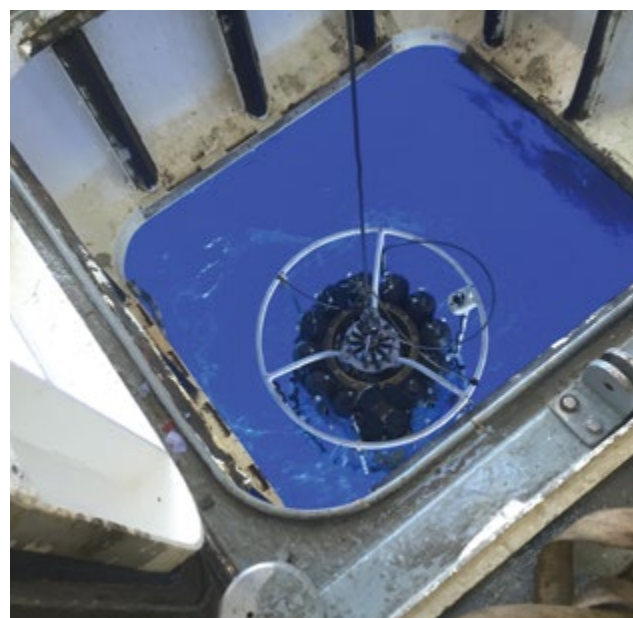
The innovation bridge has a continuous flow of people, research, skills and state-of-the-art technologies between the Global North and Africa, with regional projects extending from South Africa all the way up Africa’s eastern coastline. The Ocean Science Campus at Nelson Mandela University, in partnership with Rhodes University – which brings fisheries science into the mix – forms the principal southern footprint of the bridge. “Nelson Mandela University, with its African partner institutions, is focusing on growing the postgraduate ocean sciences pipeline to over 100 students. We already have 36 master’s and PhD students registered, a number of whom have spent time at the University of Southampton and the National Oceanography Centre to acquire specialist technology skills,” says Prof Roberts.

Two Major Ocean Sciences Case Studies Launched in 2019

Through the SARChI Chair in Ocean Science and Marine Food Security, Professor Roberts secured R160-million from the United Kingdom’s Global Challenges Research Fund SOLSTICE–WIO programme (Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research in the Western Indian Ocean). The Chair is using these funds for case studies in South Africa, Kenya and Tanzania.

The South African case study is researching why the squid fishery collapsed in the Eastern Cape in 2014, while the Kenya–Tanzania study is researching how the marine ecosystems function in this region, how they are changing and how this is impacting the ocean food resources – especially artisanal small pelagic fisheries.

“In 2019 we used three Slocum marine gliders owned by the National Oceanography Centre in the UK to collect information on the continental shelf and transmit it to the South African research vessel, the *Ellen Khuzwayo*. Sensors on the gliders collected information on temperature, salinity, dissolved oxygen in the water and chlorophyll (basically phytoplankton).



The CTD (Conductivity, Temperature and Depth) being lowered into the water to depths of 2000 m to collect profiles of temperature, salinity, dissolved oxygen, chlorophyll, and water samples at various depths for nutrients

Engaged Engineering, Technology and Health Sciences

From the outset of the COVID-19 pandemic, academics from the Faculty of Health Sciences and the Faculty of Engineering, the Built Environment and Technology (EBET) combined forces with hospitals, businesses and communities in the Nelson Mandela Metro to fight the virus during society’s greatest time of need.

We pay tribute to the Executive Dean of Health Sciences, Professor Lungile Pepeta, who was taken from us by COVID-19 on 7 August 2020. A paediatric cardiologist, pioneer and innovator, he opted for new approaches that he knew would better serve all South Africans. The new Medical School, according to his vision, is based on a comprehensive approach to medicine that focuses equally on the four pillars of medicine – disease prevention, health promotion, treatment and rehabilitative medicine. He said: “The system will produce well-rounded general physicians, trained to practise in diverse communities – from our cities to our deep rural areas.”

He championed the Faculty of Health Sciences’ interprofessional education approach where all health professionals train and work together as equals in communities and share their expertise.

The Faculty of EBET’s new Executive Dean, Prof Barend van Wyk, who joined the University at the beginning of 2020, is keen to partner with the Medical School to develop medical device and biomedical engineering specialisations and qualifications. The faculty’s Advanced Engineering Design Group is already involved

in biomedical engineering projects such as the development of intelligent prosthetics to assist people with limited mobility and the development of intubation units.

Prof van Wyk commented that while it is hard to find light in the seemingly endless darkness of the pandemic, the single most valuable consequence for education during this time is that it has hastened a reimagining of options for delivery. He foresees that soon, the one-way routine activities of traditional classrooms will move to an online space, and the quality of students’ time on campus will be improved by engaging in value-added activities in laboratories and maker-spaces, working on real-world projects, participating in group work and engaging with industry.

Online expansion is being leveraged to broaden the faculties’ reach, grow postgraduate numbers by tapping into a growing national and international market, significantly increase partnerships and funding opportunities, and expand the Mandela brand. The Faculty of EBET is working on establishing new partnerships with emerging economies like Brazil and China, while reinvigorating existing partnerships with countries like Germany and France.

Opportunities for transdisciplinary research in marine and ocean sciences are being explored with the Tokyo University of Marine Science and Technology (TUMSA) in Japan. These initiatives all align with the Eastern Cape Oceans Science Economy Strategy, launched in 2020.

Mandela University Rises to COVID-19 Battle

Nelson Mandela University stepped up to Vice-Chancellor Professor Sibongile Muthwa's call to mobilise its expertise and facilities to fight COVID-19.

The University's faculties and academics combined forces with hospitals, businesses and communities in the Nelson Mandela Metro and Eastern Cape province in the battle against this global virus.

From the outset, the late Executive Dean of Science, Professor Lungile Pepeta, emphasised the importance of the entire population, adults and children, wearing face masks, combined with regular hand washing and the use of sanitisers. "This is the first and most critical line of defence against the virus and we are concerned that undetected infections could contribute 20 to 50 times the number of positive cases."

Prof Pepeta appeared in numerous public media with which the University is engaged to support health communication and health services in the Nelson Mandela Metro and province.

Once lockdown was declared in South Africa in late March 2020, teams of chemists from the Faculty of Science and the Faculty of Engineering, the Built Environment and Technology (EBET) started producing 70% alcohol sanitisers in their laboratories for public distribution. EBET engaged with local manufacturers to share available skills and resources and assist with the provincial effort.

Local doctors at the provincial hospitals expressed a pressing need for face shields and personal protective equipment (PPE). In response, engineers at eNtsa, the University's innovation hub in the Faculty of EBET, worked with Provolution 3D printing specialists to print face shields. Members of the Eastern Cape 3D printing community were invited to collaborate, and 40 responded. Meanwhile, a team from the Faculty of Humanities' departments of Visual Arts and Media Communication collaborated with the local garment industry and communities to produce face masks and PPE.

A vital piece of hospital equipment – an intubation and extubation unit – was requested by anaesthetist Dr Lorenzo Boretti at Livingstone Hospital in Port Elizabeth. A group of engineering



students and academics from the Department of Mechanical Engineering designed and manufactured prototype units to contain and evacuate any aerosolised particles containing COVID-19.

"The University has continued to support Eastern Cape healthcare facilities throughout the pandemic and lockdown, through research, testing, consultation and prototyping assistance as these requirements have arisen," says eNtsa's Engineering Manager, Julien de Klerk.

"This support includes the distribution of more than 11 000 face shields to hospitals, clinics, emergency medical services, old age

homes, private practices and other groups across the Eastern Cape. eNtsa is also working to provide subsidised engineering support – where possible – for small and medium businesses in the manufacturing sector that have to operate during these trying economic circumstances in order to remain open and avoid job losses."

It is gratifying to see so many Nelson Mandela University staff using their skills in unprecedented ways to come up with innovative solutions that tackle the COVID-19-related health crisis head on, and provide vital assistance to our communities in at the time it is most needed.

"Once lockdown was declared in South Africa in late March 2020, teams of chemists from the Faculty of Science and the Faculty of Engineering, the Built Environment and Technology (EBET) started producing 70% alcohol sanitisers in their laboratories for public distribution."

From left: Livingstone Hospital: Dr Jessica Spanenberg, Dr Ailsa Leitch, Dr Michaela Jonkers, staff nurse Genevieve Brandt.

Urgent Need to Stratify COVID-19 Testing

As part of the University's communication and engagement focus, a wide range of COVID-19-related articles on research and innovation emanating from our faculties have been published in the local and national media.

On 5 June 2020, *Business Day* published the following opinion piece by the late Professor Lungile Pepeta, Paediatric Cardiologist and Executive Dean of the Faculty of Health Sciences at Nelson Mandela University; and Professor Fikile Nomvete, gastroenterologist and Medical Programme Director of Nelson Mandela University's Medical School.

"We all need to get into the habit of being vigilantly hygiene aware. This is the most powerful defence that we can all exercise, not only to protect you from COVID-19 but also to protect you from other diseases such as TB."



Prof Lungile Pepeta

The government's guidelines about how to contain the COVID-19 pandemic require considerable revision. They currently rely far too heavily on the strategy of testing as many people as possible, which has limited yield, and, given the shortages of coronavirus test kits and the processing backlogs in the labs, this approach will not assist in dealing with this pandemic. We also don't have the systems in place to reach people in remote areas.

So how should we change the guidelines to deal with the continuing exponential rise and expected spike in COVID-19 cases at a time when increasing numbers of people are returning to work? We need to stratify testing, with the most at risk groups prioritised for testing. Broadly, the stratification should be in three priority groups: Priority A, B and C, which can be further sub-grouped.

Priority A would have five subgroups: Group 1 should be people with chronic cardio-respiratory problems such as Chronic Obstructive Pulmonary Disease (COPD), including emphysema and chronic bronchitis, a history of destructive lung TB, structural

"Maintain the safe distance of 1.5m in any situation, wear your mask, sanitise and wash your hands. Good old soap and water works very well. Sanitise all your gadgets too, such as your cellphone, computer and keys."

lung disease, chronic heart disease and hypertension; Group 2 would be patients with diabetes mellitus, particularly with end-organ involvement; Group 3 would be individuals on immune suppressing treatment whether for cancer, transplants or immune disorders; Group 4 would be people over 60 years of age; and Group 5 would be HIV-positive patients who are at high risk, in other words those with a CD4 count that is below 350 and an unsuppressed viral load.

Priority B would be all workers in healthcare facilities including clinics, hospitals, frail care centres and old age homes. Priority C would be all people who are not in the first two priority groups and this would be the low risk category.

If anyone in any of the Priority A groups experiences symptoms or has been exposed to someone who has tested positive for COVID-19, they must immediately get tested, and quarantine or isolate.

Priority B group need to be tested immediately if symptomatic or exposed to a COVID-19 positive individual to avoid the risk of transmitting in the workplace. Subsequent management steps would depend on proximity of the worker to the positive individual, use of PPE at time of exposure, and test results.

If you are in a Priority C group and are asymptomatic, keep to the basic measures of avoiding spreading the COVID-19 virus, and if

symptomatic but not requiring hospital admission, then isolate. If symptomatic and needing hospitalisation, you then get tested immediately and are isolated in that situation.

Irrespective of the priority categories that one falls under, every single citizen needs to be vigilant about observing the well-established safety and hygiene measures at all times, both at work and at home. Most importantly, we have to educate the entire population that testing is only part of the fight. First and foremost, every citizen has to guard against contracting COVID-19 by treating every single person you encounter as a potential COVID-19 carrier. This is key and it applies as much at home, as it does at work or in society.

Maintain the safe distance of 1.5m in any situation, wear your mask, sanitise and wash your hands. Good old soap and water works very well. Sanitise all your gadgets too, such as your cellphone, computer and keys. We all need to get into the habit of being vigilantly hygiene aware. This is the most powerful defence that we can all exercise, not only to protect you from COVID-19 but also to protect you from other diseases such as TB.

There is no problem with people returning to work and society returning to normal if everyone is committed to observing safety measures, including the use of PPE. It is proving futile to keep people at home in congested circumstances where they can easily infect each other if they do not practise protective habits at all times.

What we are not seeing is enough education about this. And what we are also not seeing is strong executive management of all the systems that need to work together to fight the pandemic, including the management of the quarantine and isolation sites. Any guideline changes at a provincial or national level will only be as effective as the executive management of them, and thorough and continuous education of all our people.



Prof Fikile Nomvete



National Prestigious Award for Prof Danie Hattingh

Professor Danie Hattingh, Director of eNtsa (Innovation through Engineering Institute) and Professor in Mechanical Engineering at Nelson Mandela University, has been announced as one of 2020's winners of the Honorary Medal of the Faculty of Natural Science and Technology, awarded by the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (South African Academy for Science and Art). This medal is only awarded in exceptional cases, and is the latest recognition of the important work done by Prof Hattingh and his team.

Prof Hattingh is honoured for his contribution in the field of friction welding and the associated development of the analysis of metal turbines and high pressure/high-temperature pipes. These techniques, currently being used as standard procedures at both Eskom and Sasol, are crucial to Eskom's continued supply of electricity in South Africa.

In 2001, Prof Hattingh was a visiting researcher at the School of Marine, Manufacturing and Mechanical Engineering, at the

University of Plymouth in the UK, where he participated in a research project on Friction Stir Welding and Residual Stress Measurement using Synchrotron Radiation. This research led to the establishment of eNtsa (derived from the isiXhosa eNtsha meaning "new") at what is now Nelson Mandela University.

In the mid-2000s, Prof Hattingh and his team were involved with research and development work in aid of high-value large-scale engineering projects, most notably with Eskom to develop alternative materials' sampling and weld repair techniques for its ageing steam boiler fleet.

In 2009, Prof Hattingh became eNtsa's director, and over the past ten years, he and his team of researchers have won various national awards and international acknowledgement for their groundbreaking research and applications within the friction processing arena. The institute now has an annual turnover of some R50-million, generated from industrial and government contracts for assistance with research, design, or process development.

Engaged Law

The Faculty of Law is committed to producing quality law graduates who are equipped to contribute to the betterment of society – in line with the University's core intellectual and social project – by providing an environment that is conducive to teaching, learning, research and engagement, with staff and student morale seen as being crucial to attaining the desired objectives.

On the research front, the faculty is producing an increasing body of publications in various areas of law, including transdisciplinary areas and areas that influence legal policy and practice. A number of colleagues are in the final phase of completing doctoral qualifications and all faculty postgraduate candidates are supported by a monthly Research Hub.

The faculty also hosts a prestigious South African Research Chairs Initiative (SARChI) Chair in the Law of the Sea and Development in Africa and boasts NRF-rated researchers and grant-holders.

Meanwhile, its associated entities embody the law faculty's commitment to social engagement. The Centre for Law in Action has increased its footprint to cover seven provinces and has established an international presence – mainly in the fields of law enforcement and access to justice. The Labour and Social Security Law Unit is

nationally recognised for the training it provides, particularly in the area of Labour Law, and the Law Clinic, Refugee Rights Centre, mobile law clinics and Street Law programme provide key services to the broader Nelson Mandela Bay area.

The faculty has formalised a number of important strategic appointments and relationships with distinguished judges, legal practitioners and academics during the past few years and has firm plans to introduce a "Judge-in-residence" on a regular basis when circumstances permit. The presence of all these legal luminaries and their consequent interaction with students will be an inspiration to the next generation of legal scholars at Nelson Mandela University. In addition, the faculty is working towards the creation of "LawLab", which will leverage funding received to introduce state-of-the-art legal software and technology to the operations of the university Law Clinic.

These and other developments have cumulatively enhanced the reputation of the faculty and resulted in a number of other spin-offs, such as increased internationalisation opportunities for staff and students. Meaningful engagement activities are increasingly occupying a central place in learning, teaching and research activities, as the faculty strives to support the University's mission of existing and operating in service to society.

Parents with Children in Trouble with the Law

A new model and process has been developed to provide support to parents with children in trouble with the law.

The parents of children in conflict with the law are an essential part of the child justice system, and their needs have to be addressed.

“We understand the court is the upper guardian of children but their parents or carers must be central to the system. We need to hear their voices and engage with their issues,” says Dr Zurina Abdulla from the Department of Social Development Professions.

Under the guidance of her promoters, Professor Blanche Pretorius and Professor Veonna Goliath, Dr Abdulla has published a number



Dr Zurina Abdulla

of papers on the model and process she developed in response to this area of legal and social engagement, based on research for her doctoral thesis: *A Co-constructed Practice Model for Supporting Parents of Children in Conflict with the Law*. She received the Engagement Excellence Award from the University in 2018 and graduated with her PhD in April 2019.

The model has been endorsed at the district, provincial and national level. As part of her postdoctoral research, to be completed in 2022, she will be developing a training programme for child justice stakeholders to facilitate the meaningful participation of parents in the system.

“Within the model we have categories of parents, as some parents need assistance for a number of different reasons,” says Dr Abdulla. “Their children might be involved with drugs or they don’t care or they are not coping in managing their children’s behaviour.

The new model makes provision for why the parent isn’t coping or doesn’t recognise their responsibilities. Once we know what is happening in the home environment we can help to support the parent/carer in assuming responsibility for their child.”

Dr Abdulla’s research was based on parents’ experiences of monitoring compliance with what are known as diversion orders. “Prior to joining the University in 2015, I worked in the child justice system at NICRO [the National Institute for Crime Prevention and the Reintegration of Offenders]. When children go through the local child justice court because they have clashed with the law, a diversion order is made for the child to attend programmes with NICRO, and the parents have to make sure they comply. Most of the offences are schedule 1 or 2 offences, including possession of drugs, shoplifting, breaking and entering, or assault.”

Research on this process indicated that parents often struggle to get the child to the venue for the programme and to manage the child’s behaviour, which might be causing financial issues or marital conflict, for example. Many parents find it very difficult to cope with the fact that their child has clashed with the law. There is also the initial shock when the child does not return home because they are in a police cell, or the police arrive at their home to inform them about their child.

While at NICRO, Dr Abdulla recommended that something had to be done to support parents while their child goes through the child justice system and to make sure they comply with the orders issued by the courts.

“That is how the practice model for my PhD evolved,” she explains. “Parents from the Nelson Mandela Bay Metro were recruited to co-develop the model together with child justice officials, including probation officers, the police, magistrates, prosecutors, social workers and legal aid attorneys. It was a collective and collaborative model developed over two years.”

The Nelson Mandela Bay Metro opened one of the few child justice centres in the country in 2007. “There should be far more child justice centres,” says Dr Abdulla, who has been focusing on the transformation of the child justice system in South Africa ever since she started her career as a social worker in 1998.

“We saw how children were treated in prison. Many of these children are from home circumstances that contribute to them landing up in prison. By including their parents or carers in the process, we hope to better manage children in trouble with the law and at the same time work on addressing issues in the home environment.”



Multi-agency task team to stop illegal fishing, Tanzania. Photo: FishFORCE

Organised Crime in our Oceans

The multi-crimes affecting the fisheries sector range from illegal fishing and extraction of marine resources to human trafficking and forced labour, fraud, forgery, corruption, money laundering and tax and customs evasion.

“We established FishFORCE in 2016 with the aim of improving knowledge and intelligence-led investigations and prosecutions of criminals engaged in fisheries crime in Africa and globally,” says Professor Hennie van As, an admitted advocate, public law professor, the director of the Centre for Law in Action (CLA) at Nelson Mandela University, and the head of FishFORCE,

Situated in the Centre for Law in Action in the Faculty of Law, FishFORCE is Africa’s first Fisheries Law Enforcement Academy.

“With fisheries crime we are dealing with organised crime and we need to respond at this level with the associated severe penalties,” says Prof van As. “South African fisheries are a target for organised crime and the country is losing a lot of revenue. Treasury and SARS

must become more involved. Billions of rand and national marine resources are being lost.

“Much of the illegal global multicrime activity linked with fishing is happening off the coast of South Africa, Namibia, and the east coast of Africa. The fishing vessels don’t need to go into our harbours,

FishFORCE Training

To date FishFORCE has successfully trained 892 law enforcement officers from multiple agencies, spanning numerous short courses, some of which are credit bearing towards formal qualifications such as the new Diploma in Law Enforcement.

The first training session for 2020 was delivered in Port Elizabeth from 17–21 February at the Department of Environment, Forestry and Fisheries (DEFF).

they make their transshipments offshore. It's all happening in front of us. We can actually see these vessels poaching in our Exclusive Economic Zone (EEZ) but we don't have the capacity to deal with it."

There are too few fisheries control officers and patrol vessels and at the start of the programme, the understaffed South African Police Service (SAPS) did not see it as a priority crime. This is slowly changing though and there are indications that the change was influenced by research that FishFORCE has shared in journals and popular publications, and at conferences.

Van As says: "Government needs to acknowledge the value of marine resources to the economy, to communities and as sources of food, and to allocate the commensurate resources. More fishery control officers should be appointed and properly trained, the number of fisheries patrol boats should be substantially increased, the navy should be more active in our Exclusive Economic Zone (EEZ), and successful convictions should be strived towards."

To date, many fisheries crimes, or what is officially referred to as Illegal, Unreported and Unregulated (IUU) fishing, have been dealt with as an exclusive fisheries management issue, resulting in less severe penalties that are not having deterrent effect.

FishFORCE has been strongly advocating that fisheries crimes be addressed as a priority transnational crime and prosecuted as organised crime and racketeering under the Prevention of Organised Crime Act, with severe penalties of 25 years to life. "It is encouraging that some of our courts are responding to the seriousness of these crimes," says van As.

Three major abalone (perlemoen) racketeering cases in South Africa – State v Blignaut; State v Miller and State v Brown – have been prosecuted as organised crime, with sentences of 18 to 20 years delivered in March 2018 and March 2019.

Through Operation Phakisa, FishFORCE is collaborating with the Department of Environment, Forestry and Fisheries, SAPS, the Defence Force, South African Revenue Services, National Prosecuting Authority and Home Affairs.

Van As explains that fisheries law enforcement is transdisciplinary by nature, requiring expertise in law, criminology, police science, fisheries science, fisheries management and marine living resources conservation. "Time is not on our side and far more stringent laws, combined with specialised policing and intelligence gathering for fisheries organised crimes, as well as harsh sentences, need to be prioritised at a national and international level."



Training in Tanzania. The FishFORCE Academy is helping to build fisheries law enforcement capacity along Africa's east coast.

World Leader in Fisheries Law Enforcement

In March 2020, a publication titled *FishFORCE – A World Leader in Fisheries Law Enforcement Training* was published by Nelson Mandela University. It provides an overview of the fisheries crime context and of FishFORCE's work.

Research, Advocacy and International Collaboration

FishFORCE conducts multidisciplinary research projects that include law enforcement gap analysis and evaluation, and focus on the development of national and international law and policies.

Memorandums of Understanding (MoUs) have been signed between Nelson Mandela University and Eduardo Mondlane University in Mozambique, the University of Dar es Salaam in Tanzania, the University of Nairobi and the Seychelles Fishing Authority. Additional MOUs will be signed with the Indian Ocean Tuna Commission (IOTC), the University of Seychelles, the University of Mauritius and the Fisheries Observer Agency (FOA) in Namibia in 2020. In terms of these MOUs, the universities replicate the work of FishFORCE in their countries, whilst Nelson Mandela University administers inter-agency and cross-border training.

Sustainability

The terms sustainability and sustainable development are often used interchangeably to describe the process of meeting present needs without denuding the planet's resources now and into the future.

The University approaches sustainability in a holistic manner through the interplay between ecological, social and economic dimensions, recognising that all must be considered together. Working to achieve sustainability is a continuous process in all disciplines and in the many aspects of university life, including our campuses and the larger community in which the University is situated.

Sustainability principles are embedded in the teaching and learning, research and innovation, and engagement activities of our programmes, research chairs and entities. For example, the activities of the Coastal and Marine Institute, Marine Spatial Planning, the Sustainability Research Unit, Centre for African Conservation Ecology and AEON are underpinned by a social and environmental sustainability approach. Emphasis is placed on maintaining ecological integrity, with natural resources only used or consumed to the point that they can replenish themselves.

Economic sustainability refers to human communities across the globe being able to maintain their independence and have access to secure sources of livelihood and the resources they require,

financial and other, to meet their needs. The University's economic sustainability activities include support for emerging farmers, SMMEs & entrepreneurship, enterprise development, and skills and capacity development.

The entities active in this area, amongst others, include eNtsa, the Unit for Economic Development and Tourism, FishFORCE, the Chair in Law of the Sea and Development in Africa and the Family Business Unit. Other internal role players include the Business School, Department of Agriculture, Department of Economics, the Centre for Integrated Post-School Education and Training, the Chair for Youth Unemployment, Employability and Empowerment and the Chair in Community and Worker Education.

Social Sustainability refers to universal human rights and basic necessities being attainable by all people, who have access to enough resources in order to keep their families and communities healthy and secure. Healthy communities require just leaders who ensure personal, labour, educational and cultural rights are respected, and all people are protected from discrimination. The university structures that are active in producing engaged scholarly outputs related to social sustainability include the Centre for the Advancement of Non-Racialism and Democracy, Centre for Law in Action, Labour and Social Security Law Unit, Centre for Women and Gender Studies, the Chair for Identities and Social Cohesion and the Chair in Critical Studies in Higher Education Transformation.



Solar power plant on Nelson Mandela University's Summerstrand Campus

The Greenest Campus

In July 2019, Nelson Mandela University was named the Greenest Campus in South Africa at the 8th Annual Green Campus Conference.

The annual Green Campus Conference is attended by 19 institutions of higher learning in South Africa. The award was based on the University's green infrastructure, green projects and Green Campus Initiative (GCI).

"The drive for sustainability is non-negotiable in a world where demand for our natural resources has far outstripped supply, where we are facing climate change, pollution, an excessive carbon footprint and severe shortages of life-supporting ecosystems such as fresh water," says sustainability engineer, Dr Andre Hefer, who was appointed in 2016 and works in Infrastructure Services & Sustainability.

"Over the past three years, the University has focused on achieving a sustainable, green campus with the implementation of critical projects for water, energy, waste, green/environmentally friendly policies and infrastructure development," explains Dr Hefer, who is also a mentor to the student members of the GCI, together with staff members from Student Housing, Vuyiswa Mentile-Gozongo

and Shirani Nhlanguini. The students engage in green campus drives, such as clean-ups and water saving campaigns.

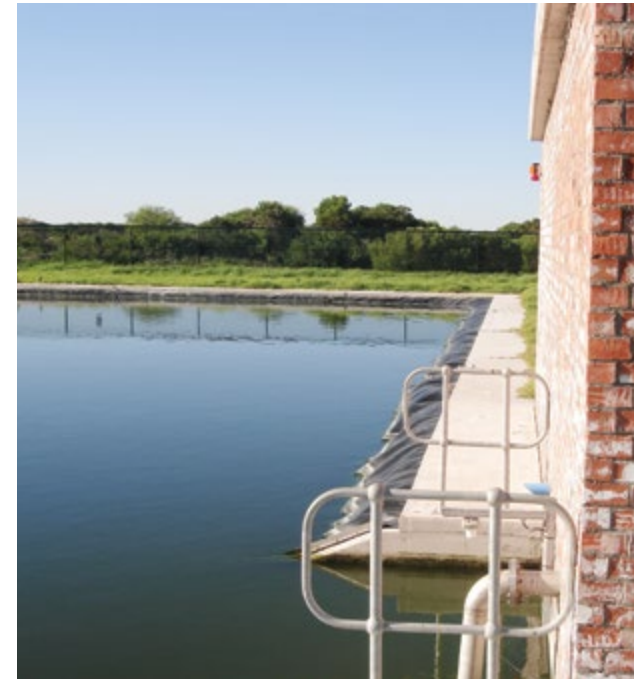
Energy

In September 2019, the University launched a R16.5-million solar power plant on its South Campus. The project is a partnership between Nelson Mandela University, Standard Bank and PPA Company – a subsidiary of the German-based Tagex.

The plant generates 1MW of sustainable electricity, contributing 14% of the total energy needs of the south campus and 5-6% of the University's total energy needs. Dr Hefer explains the agreement is that the institution buys the electricity generated from PPA, and after 10 years takes ownership of the plant. Additional solar power plants can be added as resources become available.

Water

The total water demand for the Nelson Mandela Bay Metro is approximately 300 megalitres (300 million litres) per day, and the supply from the five major dams has been rapidly dwindling over the past few years. On 25 November 2019, for example, the water level of the Mpofu Dam, a primary source of drinking water for Port Elizabeth, was 17.46%.



The new 1.3MI return effluent (RE) water holding dam on the Summerstrand Campus

The University is one of the largest businesses in the Metro and therefore a significant water user. Dr Hefer, who is also a member of the Business Chamber Water Task Team, is leading Nelson Mandela University's broad-based water conservation drive to reduce its use of municipal water and to build water resilience.

"The current overall water utility bill across our seven campuses is approximately R10-million," he explains. "The North and South Campuses in Summerstrand require up to 1.5 megalitres (ML) per day during peak periods. Our strategic objective is to increase the use of secondary sources of water – return effluent (RE) or 'new' water, borehole water, rain water and grey water – to diversify our water source, reduce our reliance on a potable municipal supply and benefit from the cost savings."

Hefer explains that the University's sport fields account for about 20% of its total water use. So instead of using potable water, they are buying water from the Cape Recife Waste Water Treatment Works which generates a quality of RE to a standard that is safe for irrigation. "The water is stored in our new 1.3 ML holding dam and we pay approximately R2.20 per kilolitre (kl) as opposed to R17 per kl for municipal water. It makes good economic and water sense. Our new residences are also geared towards the use of new water

"Over the past three years, the University has focused on achieving a sustainable, green campus with the implementation of critical projects for water, energy, waste, green/environmentally friendly policies and infrastructure development."



RE water system

for toilet flushing. We're busy working on the teething issues with this, but it's a massive solution for us and for South Africa."

Waste management

"We are in process of generating and implementing a sustainable waste management programme across all campuses, with the aim of decreasing our waste to landfill by 20% over the next 5 years; and increasing our recycled waste by 20%," says Dr Hefer.

Recycling as part of waste management will be optimised in the future to include local communities in the process, and with an increased focus on enterprise development in line with circular economy proposals. The focus will be on recyclables with value: glass, paper, plastic and metals. An overarching waste management strategy has been drafted and will serve as the foundation for future waste-related projects and proposals at various internal committees.



Intshayelelo Ekulimeni Imifuno

In 2018/19 the Department of Agriculture and Game Ranch Management engaged with 70 local communities in the greater Nelson Mandela Bay Metro in the transfer of skills to grow their own vegetables.

"The aim of this ongoing project is to provide a platform to build linkages between agricultural science, education and community," says Dr Tim Pittaway who lectures in plant production and specialises in food security, urban agriculture and agrarian sociology.

"In 2018 and 2019 our engagements included community workshops, and establishing school, crèche and church vegetable gardens, which have contributed to food security for mainly previously disadvantaged communities."

Part of the project was to include Nelson Mandela University agriculture students in community service, the teach the teacher agriculture mentorship programme, and the building of a technology transfer initiative. The technology transfer part included



Xolisile Dingswayo

developing an agriculture website to help small-scale vegetable producers to understand and adapt to their local conditions.

The site includes web links to information on farming and a short, tri-lingual booklet – *An Introduction to Growing Vegetable Gardens/ Intshayelelo Ekulimeni Imifuno/n Inleiding na Groentetuine* – that can be downloaded for free. The www.ezolimo.com website is one of the South Africa's first isiXhosa agriculture resource websites.

Master's student Xolisile Dingswayo has been part of the project since its outset and is one of the authors of the booklet. "We teamed up with the Missionvale Campus aquaponics system run by INMED – an American NPO that teaches school learners about aquaculture and aquaponics – and they distributed over 500 of our booklets to schools in the Nelson Mandela Bay Metro," Dingswayo explains.

"We also have a vegetable garden on our Summerstrand North Campus where we grow vegetables to provide for our students and postgraduates, and which we have been doing throughout the COVID-19 period. We also partner with Campus Clinic which has been providing food parcels for NSFAS students; we add the vegetables."

He adds that with vegetable prices being high, far more people are wanting to grow their own, and he helps people to grow their favourite vegetables, including beetroot, spinach, tomatoes and onions; typically planting in small spaces with careful use of water.



Dr Tim Pittaway



Nelson Mandela University, George Campus

PhDs recognised by Mandela University & the University of Lyon

Reconciling ecological and human adaptations for biosphere-based sustainability (REHABS) is the theme of the new International Research Laboratory (IRL) associated with the George Campus' Sustainability Research Unit (SRU).

The IRL-REHABS' focus is to produce original research on ecological and socio-political processes underlying the future of ecosystems and human well-being in the Anthropocene (the current geological period during which there is significant human impact on the Earth's geology and ecosystems, including climate change).

Professor Hervé Fritz who is based at the SRU has been instrumental in putting together the IRL-REHABS partnership, the contract for which was signed in 2019, as he explains: "It's built on the strong academic partnership between the CNRS (French National Research Centre), Nelson Mandela University and the University of Lyon." The official starting date was 1 July 2019, followed by a launch in early December on both the Port Elizabeth and George campuses. The Director General of CNRS, Dr Antoine Petit, the director for international cooperation, Dr Patrick Nédellec, and the Director of the Institute for Ecology and Environment were amongst the high profile attendants.

The CNRS is the largest state research institute in France, with 26 000 staff members and 14 000 researchers in 10 institutes. The IRL-REHABS falls under the Institute for Ecology and the Environment. Funding of R13-million over five years is provided by the three partner institutions, and is predominantly for PhD



CNRS head office in Paris

candidates and postdoctoral fellows, but some master's students are considered.

A cotutelle (joint doctorate) agreement is currently being finalised whereby PhDs will be recognised by both Nelson Mandela University and the University of Lyon. The French Embassy is highly supportive of the IRL-REHABS and is funding mobility for master's and PhD students between the two countries.

"Reciprocal exchanges of PhDs will take place between France and South Africa (during the first five-year period, approximately 10 PhDs registered in South Africa will have the opportunity to spend time developing their research and training in France)," says Prof Fritz. Funds are also available for fieldwork.

The term 'biosphere-based sustainability' is used in the theme to give sustainability specific meaning. "The idea is to develop an understanding of the effect of humans on the world's ecosystems (biosphere), and also how the natural environment benefits humans (in terms of health, wellbeing and resources). Linked to this is how you set up the governance of these critical issues," Prof Fritz explains.



"Reciprocal exchanges of PhDs will take place between France and South Africa (during the first five-year period, approximately 10 PhDs registered in South Africa will have the opportunity to spend time developing their research and training in France)."

"We address this through cross-cutting projects, such as a project that researches how to make multifunctional landscapes sustainable in delivering the ecosystem services on which humans rely. Another example would be to research how to manage livestock farming hand-in-hand with environmental stewardship so that livelihoods and the environment can both flourish.

"Despite the slowing down of all activities with COVID-19 we are moving fast in terms of being very effective operationally with our research programmes here and in France, with Lyon as the gateway to other French universities.

The first Mandela University PhD student to go to France, in 2019, is Francis Martens who researches vultures. She went to the Centre d'Ecologie Fonctionnelle et Evolutive, CNRS-University of Montpellier, and AgroParisTech, Paris Sorbonne to work with French vulture specialists, and to experience how vultures have been reintroduced in France.

The IRL-REHAB is creating an interesting space for postgraduates and researchers in the hybrid supervision environment – it's a new way of doing research and being exposed to- and interacting with researchers from different countries.

First group of cotutelle PhDs hosted by the IRL-REHABS at Nelson Mandela University and French universities:

Registered late 2019

Elie Pedarros (French). PhD title: *Combining biodiversity monitoring and local knowledge to understand the ecology of large mammals within anthropogenic landscapes and to catalyse conservation in southern Africa. Cotutelle Nelson Mandela University (SRU)-University of Lyon.*

Alice Bernard (French), PhD title: *Trophic guild distortion in anthropogenic landscapes – Testing anthropodependence and reconciliation ecology principles in African mammal species. Cotutelle Nelson Mandela University (SRU)-University of Lyon.*

Registered in 2020

Zanri Schoeman (South African), PhD title: *Assessing the effects of fish stock management on endangered seabird populations in South Africa. Cotutelle Nelson Mandela University (School of Natural Resource Management)-University of La Rochelle, France.*



Beef cattle on a land reform farm

Emerging Farmers and Land Reform

The success of emerging farmers in the land reform process is essential to political stability, democracy and food security in South Africa.

"Land reform is not about ticking the boxes of how many emerging farmers have been given a piece of land and some capital input to farm; it is about ensuring that they are able to be self-sufficient and make a living from farming," says Johan Jordaan, a senior lecturer in the Department of Agricultural Management at the School for Natural Resource Management on the George Campus.

Jordaan leads the Agricultural Management Department's participation in a programme that works with emerging livestock farmers in the greater southern Cape area of the Western Cape.

The department's engagement with the farming sector helps ensure that teaching and research remain relevant and in sync with farming needs. This is especially relevant in the context of policy issues such as agricultural land reform, food security and sustainability.

"We partner with the Western Cape Department of Agriculture in helping to address the critical financial and farm management skills shortage of newly established land reform beneficiaries, to assist them to manage their operations on a sustainable and commercial scale," he says. The Agricultural Management Department has been a close partner since the programme's inception in 2007, when it was initiated by Manie Grobler, Specialist Agricultural Advisor: Livestock, from the Western Cape Department of Agriculture in George.

In 2019, the programme evaluated the projects of eight emerging farmers from different backgrounds, including farm labourers, employees in town, or those farming in their spare time on the commonages around where they live. The farmers are from George, Mossel Bay, Riversdale, Ladismith, Oudtshoorn, De Rust and Knysna.

The farms are small, ranging from 60 to 225 ha and are either privately owned or leased from government and operated as



Emerging Angora farm

cooperatives. Livestock enterprises consist of beef cattle, mutton sheep and one Angora goat operation. Herd numbers vary between 60 and 100 animals depending on the condition of the grazing; however, the Angora farmer has 200.

“As part of our engagement initiative, the BTech Agricultural Management students spend two weeks every year in the field, working together with the farmers and extension officers from the Department of Agriculture,” Jordaan explains. “Students assist with performance recording activities, such as weighing and classing of animals, marking, vaccination and dosing if needed. A comprehensive survey of production and management practices of the past production year is then done.”

Hands-on engagement with farmers enhances the employability of students in terms of their skills and competence to perform practical management and financial analyses of developing farms.

“Back on campus after the fieldwork period, students spend another two weeks using this information to do a full economic analysis of

each farm. The profitability of each livestock enterprise is analysed individually, followed by an analysis of the entire farm operation to determine profitability and return on investment. Grobler and his team of agricultural advisors analyse the data and present the survey results to farmers during an information day, to assist them with management and planning, and to aid the Department of Agriculture with their extension and support functions to first-time farmers.”

The financial performance data is shared with the Farmer Support and Development Programme (FSD) of the Western Cape Department of Agriculture for use in future project development planning. The FSD encompasses the broad development agenda of the Department of Agriculture to enhance the land reform programmes through institutional capacity building of historically disadvantaged communities and individuals.

The farming units seem to be too small to be operated as commercial livestock farms, impacting farmers’ contribution towards sustainable food production and their ability to generate the expected returns on investment. Apart from economies of scale, the dynamic modern agricultural business landscape also demands a certain level of knowledge and competence from farmers. Ideally, consideration should be given to a larger investment in training and upskilling of farmers as part of the land reform agenda.

“It’s essential that government addresses this to contribute to land reform becoming a success, which it is not at present, and which is a major concern for the whole country,” says Jordaan. “Adding to this is that in the past there was a lot of money forthcoming from government for land reform, and farmers received sizeable grants for capital outlay of infrastructure and to stock their farms; but with government funds dwindling it will be crucial for farmers to be self-reliant and to be able to make a livelihood from farming.”



Johan Jordaan



Curtain Place, by Waugh Thistleton Architects, is a six-storey CLT development situated in the heart of Shoreditch, London. Photo: Waugh Thistleton Architects

The CLT Revolution

After almost 150 years of using concrete and steel in construction, the world is returning to wood. This time around it is the revolutionary wood product, Cross Laminated Timber (CLT) that is transforming building globally.

By April 2021, the George Campus will have a showpiece CLT building that will indicate a new direction for design and construction in South Africa. CLT and mass timber construction is already making significant inroads in Europe, North America, and Australia as the low carbon, sustainable, economically competitive construction material of choice.

Responding to this, the Faculty of Engineering, the Built Environment and Technology (EBET) has embarked on an ambitious CLT initiative in partnership with an Italian construction company, Innovhousing, and a growing number of university and industry partners.

“To advance the adoption of CLT in South Africa we have established the CLT Engagement Unit as a transdisciplinary entity at Nelson Mandela University,” says the unit’s coordinator, Dr Ossie Franks.

“With design approval in 2019, and considerable input from the Deputy Vice-Chancellor: People & Operations, Lebogang Hashatse, the University Council approved a commitment of R4.4-million to the CLT building project. Innovhousing has invested R6.4-million,” says Dr Franks. Innovhousing benefits from having a showcase for CLT construction in South Africa’s public and private sector, and promoting CLT building technology and the industry in this country.

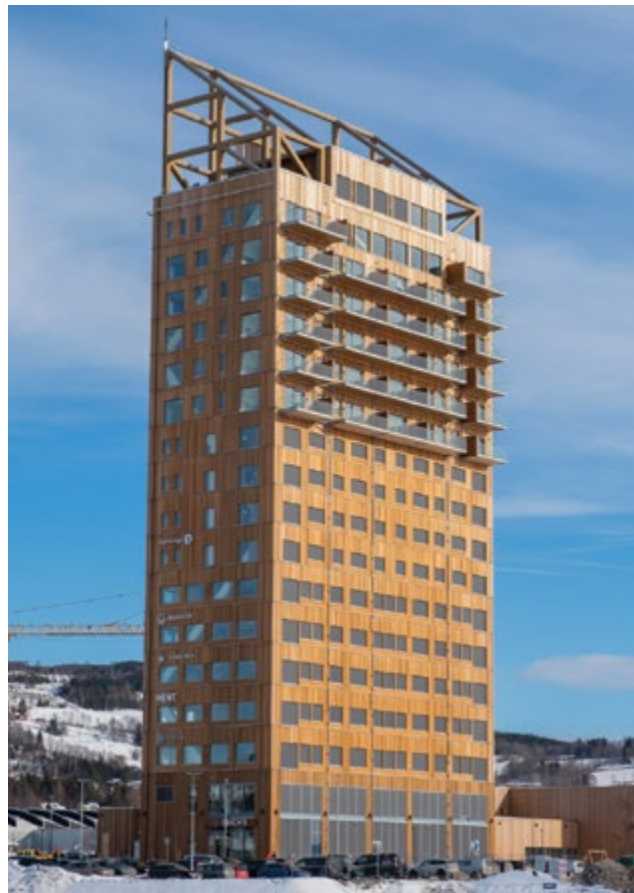
The sustainably harvested wood used in CLT acts as a substantial carbon reservoir, and its production requires much less energy than conventional building materials, such as concrete and steel. “This is the right technology for the times,” says Innovhousing’s founder and CEO, Eugenio Bin. “South Africa has a massive carbon

footprint and a significant housing and building backlog. CLT offers the solution, as a carbon neutral, sustainable way of building.”

The entire CLT building is being prefabricated to the highest standards in Europe, as the South African industry is still in its infancy. It will be delivered to site, flat-pack furniture style, and can be erected in a matter of days. Importantly, heavy or mass timber is inherently fire resistant: in the event of a fire, the external layer chars, protecting the inner structure of the beam or panel.

Rothoblaas – an Italian company with a base in South Africa that specialises in high tech solutions for wood builds – is one of the CLT Unit’s preferred suppliers. They collaborate with a number of European universities on the research, development and sales of mass timber products, including fixing systems, machinery and equipment for woodworking, and systems for air sealing, waterproofing and noise reduction.

“The University will use the building to advance knowledge and skills about CLT and mass timber in construction, and incorporate this into our curriculum and transdisciplinary research, including in engineering, architecture, construction management sciences, and business and economic sciences,” says Dr Franks. “We are



Mjöstårnet – Moelvern Wood Construction. The 85.4m high building was opened in March 2019 and is officially the world’s tallest timber building. Mjöstårnet has a combined floor area of around 11 300 square metres. The building has 18 storeys that include apartments, a hotel, offices, a restaurant, a rooftop terrace and common areas. Photo: Moelvern Wood Construction

The CLT Engagement Entity is focusing on:

- Developing the CLT undergraduate curriculum and postgraduate research
- Building partnerships with international frontrunners in CLT and mass timber construction
- Building government partnerships, notably with DTI and DEFF, to develop CLT as a sustainable, low-carbon industry in South Africa
- Collaborating with CLT companies such as Rothoblaas – an Italian company that specialises in high tech solutions for wood builds, which is partnering in the George building;
- Skills development: working with the TVET colleges to incorporate CLT into training artisans such as carpenters and assemblers; CLT skills training for structural engineers, architects, quantity surveyors and construction managers
- Securing funding from the Fibre Processing and Manufacturing Sector Education and Training Authority (FP&M SETA) for skills training and curriculum development work
- Engaging with local communities and the forestry and timber sector to partner in mass timber supply, with associated job creation.

partnering with a number of universities and companies in Europe and North America that are frontrunners in this field.

“We are also creating a community of practice between different faculties within Nelson Mandela University, other educational institutions, and role players such as Forestry South Africa, Sawmilling South Africa, the South African Wood Preservers Association, the Institute for Timber Construction, the National Home Builders Registration Council (NHBC) and the Department of Trade and Industry.”

Sustainability engineer at Nelson Mandela University, Dr Andre Hefer, is overseeing the infrastructure and sustainability side of the build. The development of the building is overseen by Emma Ayesu-Koranteng who is doing her PhD on establishing CLT in the South African construction industry and tailoring appropriate qualifications, based on experience from leading international universities in the field. Meanwhile, Professor Jos Louw from the School of Natural Resource Management is collaborating with the Department of the Environment, Forestry and Fisheries (DEFF) to investigate the potential for new industry and job creation.

“There are 22 000 ha of formerly forested land in the Cape’s forestry regions, currently standing empty,” he explains. “The re-forestation of these areas could serve as a catalyst for the CLT industry, economic growth and employment.”

Alien Invasive Plant Management on the Garden Route

In June 2017, one of the worst wildfires on record burned 15 000 hectares along the Garden Route. The fire’s intensity was heightened by invasive alien plants and commercial plantations.

While some of the area that burned in the 2017 fire was in natural vegetation (mainly fynbos shrublands), more than half consisted of invasive alien plants (IAPs). This included commercial pine plantations and other invasive pine, wattle and eucalyptus trees, whose inflammability fuelled the fire’s intensity.

“It called for research on the management of IAPs, as fires of this severity could happen again if preventive measures are not taken to limit the fuel loads,” says Dr Tineke Kraaij from the School of Natural Resource Management, who researches fire ecology in South African vegetation types, particularly fynbos.

Doctoral candidate Current Masunungure has taken up this challenge. Conducting his research through the Sustainability Research Unit on the George Campus, and supervised by Dr Kraaij and Prof Christo Fabricius, Masunungure’s thesis focuses on the management of woody invasive alien plants in the Garden Route Biosphere Reserve. In this 700 000 hectare reserve, bordering South Africa’s southern coast, IAPs are not only a major fire risk, they are the single biggest threat to biodiversity and consume a vast amount of already scarce water.

Masunungure is on a scholarship from the Southern African Systems Analysis Centre (SASAC) – a scholarship programme awarded to South African and southern African doctoral students registered at South African universities.



Current Masunungure

“The complex nature of the IAP problem and the magnitude of its impact on the environment makes planning and decision-making for the management of IAPs a challenge,” says Masunungure. “Given the high cost of controlling IAPs and limited resources, it is important that IAP management operations are carefully planned.”



5 000 hectares of forest plantations were destroyed in June 2017 when one of the worst wildfires on record raged through the Garden Route.

There is wide consensus about what needs to be done, including preventing new invasions and reducing the impact where eradication is not feasible. Various programmes and projects over the years have been working on clearing tracts of the IAPs but these efforts are often uncoordinated and sporadic.

“The problem requires far more sustained collaboration and pooling of resources,” Masunungure explains. “Extended public works programmes like Working for Water and Working on Fire

“The complex nature of the Invasive Alien Plant (IAP) problem and the magnitude of its impact on the environment makes planning and decision-making for the management of IAPs a challenge.”

have both been involved, but they tend to work separately instead of collaborating between themselves and with other organisations to share resources, equipment and staff in joint operations.”

Using systems analysis, Masunungure’s research seeks to develop and propose decision support systems to inform appropriate options for IAP management. “Through stakeholder workshops I identified 43 variables which I divided into six inter-related clusters: ecology, biodiversity, efficiency, economic impact, social impact, and government policy, all of which are inter-related. From these, I identified a system archetype, to identify what causes the system to behave in a certain way, such as why IAPs continue to spread, and what sort of systems architecture can be used to overcome this.”

Masunungure was one of ten SASAC scholars awarded a British Council Newton Fund Mobility Grant to pursue his research in the UK and Austria in 2019. “I worked on my review chapter at the University of Stirling in Scotland for three months, where they have outstanding facilities and systems software, which significantly boosted my understanding of the support systems and tools used in the systems discourse,” he explains. He went on to spend six weeks as a guest research assistant at the International Institute for Applied Systems Analysis in Vienna, developing a support system for his project, working with internationally acclaimed researchers.

“The goal of my work is to see how it can influence policy in South Africa. I am pushing for public-private sector partnerships.



Chemical control of black wattle

The private sector needs to come on board in various ways, with incentives such as higher sales prices for properties that are cleared of IAPs, or companies incentivising farmers to clear IAPs on their land.

“The timber industry, for example, needs to review management in the commercial plantations around Knysna, for example, which are fire-prone parts of the landscape. The region’s municipalities need to consider fire-risk in their town planning and look closely at the location of developments in relation to bergwind-driven fire paths. The 2017 fires burnt many areas where there was poor residential planning, including informal settlements, as well as low-density estate developments situated on hilltops with plenty of alien-invaded fynbos around them.



Dr Tineke Kraaij

“Overall, what is needed is a systems approach that includes ongoing control of IAPs, the reduction of plantations in fire-prone areas, the re-introduction of prescribed burning programmes – particularly in the urban-wildland interface – and the strict regulation of town development in areas of high fire risk,” Masunungure concludes.

Researching Existing Firms for Future Business Growth

Enterprise development for job creation and growth based on what makes existing businesses successful is a critical research focus for South Africa.

A research team from the Faculty of Business and Economic Sciences selected enterprise development for job creation as part of its 2019/20 engaged research focus.

“South Africa’s economic survival hinges on enterprise development, particularly the development of SMMEs. In the Eastern Cape about 69% of SMMEs create jobs only for the owner, which is self-employment rather than job creation, a role played by only 31% of SMMEs in the province,” says Professor Syden Mishi from the Department of Economics, who is leading the team.

“To create jobs in South Africa we have to rethink enterprise development. We need to look at the drivers for job creation and study firms of all sizes that are successful at this and what sector they are in so that we have a tangible strategy for proposals to national and provincial government.”



Prof Syden Mishi

Based on this, Prof Mishi’s team submitted a project proposal titled: *Firm and product survival analysis: evidence from South African Tax Administrative data*, in response to a call from UNU-WIDER (the United Nations University World Institute for Development Economics Research) under the Southern Africa-Toward Inclusive Economic Development (SA-TIED).

The team includes Prof Mishi, Prof Ronney Ncwadi, Weliswa Matekenya, Dr Leward Jeke and Dr Roseline Karambakuwa. In order to analyse how many enterprises have lasted and grown beyond five years, in which sector and with which products and services, they have obtained special permission to access the National Treasury-South African Revenue Service (NT-SARS) anonymised dataset on every registered business in South Africa. “It goes without saying that we treat the company information as completely confidential,” says Prof Mishi.

“We are interested in how South African firms are able to survive and grow, how they are innovating to keep pace with technology and changing demands, and how they are surviving in the international

“In the Eastern Cape about 69% of SMMEs create jobs only for the owner, which is self-employment rather than job creation, a role played by only 31% of SMMEs in the province”

market. Export is one of the unique sectors that South Africa needs to tap into far more extensively in terms of growth.”

The team started their research at Treasury in January 2020 but have been delayed by COVID-19. “Access to the NT-SARS dataset gives us the competitive edge to consolidate the research on enterprise growth and job creation that we have already undertaken, particularly in the Eastern Cape,” says Prof Mishi.

He emphasises that the Eastern Cape economy is not nearly as diversified as it should be; it is currently concentrated in government services and four other sectors: trade, catering and accommodation, including tourism services; real estate and business services; manufacturing; and storage and communication services. Sectors like construction and agriculture are very small in the province and have great untapped potential if water and energy supply efficiencies are improved, maintained and sustained.”

Adding to their research, Prof Mishi says that ±22% of people employed in the Eastern Cape are employed in the informal sector.

“Widespread sentiment is that the process of formalising and starting a new business is too complex, from registration to submitting tax returns, and all the UIF and workers’ compensation

forms. So we need to look at how we can streamline this and make it easier to unlock more new business development and growth.”

Looking at the SMMEs per sector in the Eastern Cape, Prof Mishi explains another issue is that the majority are listed under community, social and personal services. The reason for this is that 29% of SMMEs are created in response to government tenders, so this cannot be regarded as entrepreneurship. “How sustainable in terms of long-term job creation is this? Even if I get a large tender now and create jobs for five years, if the tender is not renewed thereafter then my business fails, or if someone who helped me to get that tender is no longer in that position, then my business is at risk.”

Prof Mishi concludes, “The NT-SARS dataset has in-depth information from which we can extrapolate the background to the business’s establishment, the kind of products it produces and the success or failure factors in each case.

This is especially critical with a lot of businesses in distress as a result of the COVID-19 pandemic. It is the ideal opportunity to look at the data and to see how businesses can be supported and which businesses are managing to survive and why. The only way to do this is to unlock the detail: the devil is in the detail, as the saying goes.”



A micro business - Phone Shop and Siyacheba (‘we cut hair’ in isiXhosa) – was well located next to Ekuzoleni senior primary school in Maketheng village, 3.5km from the town of Sterkspruit in the Eastern Cape. It was a sound entrepreneurial idea that didn’t take off. The owner explained that the majority of people prefer to trust and support the “big/ formal businesses” in town. Photo: Prof Syden Mishi

Social Enterprise Architecture

The School of Architecture advocates an approach to architecture and the built environment that evolves from a critical engagement with natural and built ecosystems towards making humane, inclusive and sustainable environments. This approach to architecture is rapidly gaining traction globally as a mode of practice that expands the role of design education, research and innovation beyond the academy.

The school’s design studio for second-year students, Studio Make, focuses on real-life projects in local communities. John Andrews, architect and senior lecturer in the School of Architecture, explains: “It is an opportunity for students to engage with the tectonics of architecture as a social, expressive and technical undertaking: to work collaboratively under professional guidance with real construction and materials, and in an authentic project context – underpinned by a socially sympathetic cause and real-world ethical responsibility. The real-world setting of the design and build project

contributes to a humanising, critical and transformative practice in architectural education and design.”

He quotes Yale University’s Adam Hopfner who explains that the design and build is “not just learning how to swing a hammer or how something sits on something else, there’s a real interest in being citizens of a larger community. ... We’re trying to deconstruct students’ privilege. We’re trying to get them to be better citizens, better community advocates.”

This approach to architecture aims to integrate the core functions of the university – teaching and learning, engagement and research or creative works – to be of service to society and create a “balanced” and “relevant” education. Taking up the opportunity to engage in real-life projects also means that these pedagogical agendas can be satisfactorily fulfilled, while at the same time contributing in a meaningful way to the broader Nelson Mandela Bay community.

Social Enterprise Architecture or Engaged Architecture

The School of Architecture advocates an approach to architecture and the built environment that evolves from a critical engagement with natural and built ecosystems (and the socio-economic, cultural and physical aspects of their contexts), towards the making of humane, inclusive and sustainable environments.

As demonstration of this approach, the Studio Make design studio for second-year students focuses on real-life projects in local communities. It affords students and staff a remarkable field-based opportunity to engage with real needs and real people, while at the same time engaging with hands-on construction and interaction. This approach to architecture is rapidly gaining traction globally as a mode of practice within university design studios that expands the role of design education, research and innovation beyond the academy.

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Second year architecture students at work on Crèche13 (from left) Helene Richter, Mokgeti Machete, Cameron Watkins (in the window), Rachel Molisy and Katelin Hagemann.



Crèche13 assembled on the Summerstrand campus

By the People for the People with the People

A new aesthetic has been created in working class and township areas where communities co-create beautiful, practical, low-cost, low-tech buildings.

Crèche13, a portable, multifunctional, beautifully designed crèche, is a new landmark in the informal settlement of Airport Valley in Walmer Township, Nelson Mandela Bay. It is a fine example of sustainable, social enterprise architecture which raises deep pedagogic and academic interrogations about architecture – by whom, for whom, with whom?

Conceived and led by John Andrews, architect and senior lecturer in the School of Architecture, the Crèche13 project was designed and built by second-year students in 2019/20 as part of their academic curriculum, in collaboration with the Airport Valley community.

"We identified an existing crèche, in collaboration with the Walmer Angel Project, a longstanding non-profit in Walmer Township. The crèche caters for about 40 children in Airport Valley, in a shack construction in dire need of attention. These children and the current caretakers, Tembeka Mbada and Nombulelo Zweni, have since moved into Crèche13, situated at a site nearby."

The innovative project draws on a pre-manufactured "kit-of-parts" strategy which allows for portable architecture, using low-cost materials (corrugated iron and standard timber), low-tech

construction techniques, recycled shipping containers and roof sheeting. "The architecture of Crèche13 reinterprets the use of industrial materials to create a dignified, habitable building that is a delight for the children of an area typified by dire living conditions," says Andrews.

An essential aspect of the project was engaging with Airport Valley and Walmer Township representatives and ward councillors throughout the entire process, from design development to completion. The project also engaged with different faculties in the University (construction management department, legal services, ethics, and safety, health and environment), the profession (structural, health and safety, specialist contractors), and the Nelson Mandela Bay Municipal Metro (land planning and the building inspectorate).

The building was manufactured on campus in 2019; it was then disassembled and moved with crane trucks to its Airport Valley location in January 2020. The rationale behind its portability is that the crèche can be moved anywhere. This makes it compatible with the dynamic environment of the South African informal settlement landscape while complying with stringent municipal regulations. Crèche13 was handed over to the community in February 2020 and is being managed and maintained by the Walmer Angel Project.

"Crèche13 is a quality construction that contributes to a conducive



Crèche13 Mascot. Photo: Wendy Poole

Tectonics and the Architecture of Community

The School of Architecture's design exhibition at the end of May 2019, presented 16 projects that all reflected different approaches to the technologies possible in the making of economic and community relevant architecture.

Under the title *Tectonics and the Architecture of Community*, the projects explored three themes: re-use, off-the-shelf and containers:

- *Re-use* looked at possibilities of reusing waste products – such as plastic bottles, oil drums and pallets – in construction
- *Off-the-shelf* looked at possibilities of using “cheap” industrial materials
- *Containers* looked at the versatility of using single or multiple shipping containers.

Overlaid within these explorations were ideas of architectural dignity, portability and the making of functionally flexible architecture.

environment for our pre-school children to flourish. What the University has done is great and we are very grateful for the partnership,” says Walmer Township ward councillor, Ayanda Tyokwana.

Andrews presented the project at the *Knowledge and Pedagogy Symposium: Mapping Decolonisation, Transformation and Digitalisation Praxes*, Nelson Mandela University, 19 September 2019 and at the Eastern Cape Institute of Architects on 6 March 2020. In these presentations, Andrews demonstrates how this teaching practice might contribute to a more situated, critical and inclusive teaching and learning environment, while adding value to the greater community.



Crèche Caretakers Tombeka Mbada and Nombolelo Zweni at the site identified by the community for Crèche13. Photo: Clayton Johnson-Gossard

African Footprint

For a century, Africa has received global scientific attention as a source for understanding the evolution of *Homo sapiens* – the cognitively adept species of the genus *Homo* that migrated from Africa across continents. In the last few decades, evidence has revealed the importance of South Africa, in particular, for unravelling the cognitive evolution of our species. Some of this study has focused on the southern Cape, which hosts an unprecedented array of archaeological sites and evidence of cognitive modernity. Mandela University's African Centre for Coastal Palaeoscience (ACCP) has played an important role in unravelling many secrets of this “Cradle of Human Culture”.

The palaeo-archaeological evidence is supported by advances in neo-ecological approaches, driven predominately by the ACCP. Today's Africa and Africans are invaluable for better understanding our origins story. The various habitats surrounding important archaeological sites and the people who still inhabit these habitats offer science modern analogues that have successfully been extrapolated to pre-history.

The present informs the past through multidisciplinary collaboration that allows for transdisciplinary methods. For instance, botany, ethno-botany and other aspects of ethnography are crucial in preparation for human behavioural ecology. This transdisciplinary approach allows us to reconstruct climate and vegetation, and uncover drowned or extinct landscapes, as well as reconstructing the past “resource-landscape” – what resources were available to early humans.

This research cannot be done without Africa and its Africans: their stories talk of our human story. Collaboration was key to the successful fruition of our species, where not only resources were shared, but knowledge – such as novel technological advances – too. Our development was possible because humans ratcheted up technologies through sharing across generations. We are also now beginning to understand how different groups collaborated, evident from comparison between archaeological sites over a vast geographical distribution. *Homo sapiens* owes Africa and Africans for revealing our shared ancestry, for helping us understand our shared past, and for the message, grown through time, to build our future.



Rock in the shape of a stingray found in the Still Bay area, could be the oldest image ever found of a human creating an image of another creature. Photo: ACCP



Hatchling turtle tracks – the moment they hatch in the sand, they run for the sea – capturing an instant in time $\pm 120\,000$ years ago. Photo: ACCP

Welcome Home, *Homo sapiens*

The origins of human self-awareness have been traced to South Africa's southern Cape coast. This is of global importance as it sheds light on human cognitive development.

The combination of archaeological sites, ancient art, and fossilised human and animal tracks found on South Africa's southern Cape coast are unique. Nothing like this exists anywhere else in the world.

"Based on our research in this area, we can, with increased confidence, say welcome home, *Homo sapiens*," says Dr Jan De Vynck, Director of the African Centre for Coastal Palaeoscience (ACCP) at Nelson Mandela University.

The ACCP is playing an integral role in unravelling the secrets of this region, known as the Cradle of Human Culture. With a multidisciplinary international collaboration, the ACCP research team has made numerous astonishing finds from the Palaeo-Agulhas Plain (PAP), a submerged landscape spanning 85 000 km², lying off the southern Cape coastline. The plain was exposed for much of the past, when ice ages caused sea levels to drop. "Humans roamed this landscape from at least 164 000 years ago, during the second last Ice Age," says Dr De Vynck.

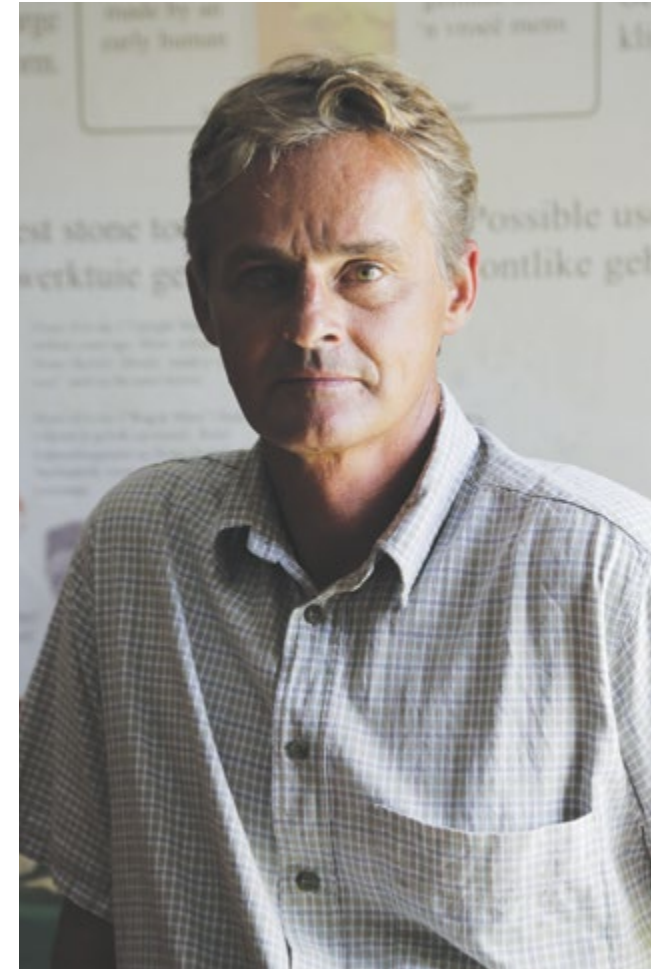
Extending out to sea from the current coastal area, the PAP was a flat savanna-type grassland, with broad rivers meandering over it, forming wetlands and deltas. Various species of extinct megafauna – large mammals – lived here. The "trackways project" research team found tracks of the extinct Cape giant horse, the extinct long-horned buffalo, rhinoceros, elephant, hippopotamus, crocodile and giraffe. Tracks of baby giraffe and hatchling turtles indicate that these species were successfully breeding here. On one of their exploration days, the project's ACCP primary investigator, Dr Charles Helm, and De Vynck, discovered 22 fossil track sites on fossilised dunes and beaches. To date, more than 250 track sites have been identified.

"We are calling this the Golden Age because of the wealth of finds our fieldwork is discovering through this glimpse back in time, when human and animal tracks were made on beaches and dunes, and then buried in sand. For a brief window we are able to find and document this phenomenal record of the past, before the wind and sea erode and destroy the tracks once more, and they are gone again, forever."

The researchers also now know that humans have been expressing themselves for at least 100 000 years. "We have evidence of this from numerous Middle Stone Age archaeological sites in the broader Cape," says Dr De Vynck.



Dr Jan De Vynck and fossilised giraffe tracks dated to at least 100 000 years old. Photo: Dr Gerrit Mars



Dr Jan De Vynck

"There is evidence that humans started to forage from the sea 164 000 years ago, as evidenced by the vast deposits of discarded shells in middens in the cave."

Homo sapiens – or modern humans – he explains, are defined both anatomically and cognitively. "One of the key indications of cognitive development is self-expression, through symbols (e.g. artworks), jewellery and body painting. One of the most provocative finds to date is what might be an ancient sculpture of a stingray, created in the sand in the Still Bay area between 70 000 and 158 000 years ago. It is currently being more precisely dated in the UK but, if this speculation is correct, then this is the oldest example ever found of a human creating an image of another creature." Other evidence of humans making patterns in the sand is a circle drawn as if with a compass, and a "hashtag" sign.

Possibly the oldest examples of cognitively modern, conscious human beings are at Pinnacle Point Cave in Mossel Bay. Here, honorary professor at Nelson Mandela University and international director of the ACCP, Dr Curtis Marean, and his team found what is being coined "the oldest human seafood restaurant in the world."

There is evidence that humans started to forage from the sea 164 000 years ago, as shown by the vast deposits of discarded shells in middens in the cave. "We know from these shells that humans had been harvesting shellfish in the intertidal zone," Dr De Vynck explains. "The intertidal zone is only viable for shellfish



Dr Jan De Vynck investigating a palaeo-dune formation east of Still Bay. The area is rich in fossil trackways left by animals and humans in the late Pleistocene. Photo: Dr Gerrit Mars

“ ... shellfish on the southern Cape coast are extremely productive and resilient, and the richness of the resource could have influenced increased social complexity.”

harvesting for three days before, on and three days after the spring tide, which happens every new moon and full moon – a total of 14 days in a 28-day lunar cycle.”

Shellfish and other aquatic resources are extremely rich in the specific nutrients the brain requires to grow, such as iodine and

omega 3 polyunsaturated fatty acids. Also, shellfish on the southern Cape coast are extremely productive and resilient, and the richness of the resource could have influenced increased social complexity. These humans had a rich source of terrestrial plant foods too, including bulbs and berries, and plentiful game. All this would have facilitated the cognitive development of early humans.

In uncovering these clues, the ACCP does transdisciplinary work with dozens of researchers from Africa, America and Europe and with over 40 universities. “It is a beautiful example of research between the disciplines as it includes, amongst others, ethnobotany, ichnology (the study of tracks and traces), geology, human behavioural ecology, palaeobotany, archaeology, ethnography, and experimental archaeology,” says Dr De Vynck, who is also an honorary researcher at the Evolutionary Studies Institute at Wits and at the SapienCE Centre for Early Sapiens Behaviour at the University of Bergen in Norway.

In May 2020 the journal *Quaternary Science Reviews* published a special issue called *The Palaeo-Agulhas Plain: a lost world and extinct ecosystem*. It includes 23 papers from global contributors, many being ACCP authors and co-authors.

“In addition to scientific engagement and growing diversity in our work through our postgraduate cohort, another very important aspect is citizen engagement. In February 2020, for example, a feature titled “Early Human Footprints & Sculptures in the Sand”, written in accessible language and illustrated with striking photographs, was published in the South African Airways’ in-flight magazine, *Sawubona*. Our aim is for science to become accessible to everyone and we are working with a range of media to suit different audiences. We are also working with a number of young people from local communities, such as Still Bay, who are training as field trackers and archaeo- and ecotourism guides.”



Cultural Heritage of the Khoisan in the Eastern Cape

Part of the process of decolonisation is the recognition of indigenous heritage and the role of indigenous communities in the foundation of this country.

“The origins of the southern African territory were shaped by the Khoisan people. There are multitudes of traces scattered throughout the terrain that testify to this, ranging from ancient fish traps to rock art,” says senior lecturer, researcher and artist in the School of Architecture, Dr Magda Minguzzi.

“Due to a long history of genocide, repression and dispossession of the indigenous inhabitants, the connection with their heritage sites has been interrupted. The Khoisan have no rights to their own sacred places and cultural heritage today; it is vital to revive the knowledge and re-establish a sense of belonging in order to treat those ‘places of origin’ with the reverence and value they deserve.”

To bring back to life part of this tangible and intangible heritage, Dr Minguzzi is collaborating with local Khoisan leaders to investigate,

visit and document sacred heritage sites and ancient oral stories in the Eastern Cape. “These visits are unique moments and the process is often difficult because some of the sites are located on private property. The process can be seen as an act of ‘decolonisation’ of the territory through the recognition of indigenous heritage in the foundation of this country.”

The work, titled *The origin of things: investigation on the Khoisan places*, was awarded three years of funding by the National Research Foundation (NRF), starting in 2019. The research group includes chiefs and members of the Khoisan community in the Nelson Mandela Bay Metro, and staff and students from the School of Architecture.

During 2019, they concluded the first scientific site surveys at precolonial fish traps located along the Eastern Cape coast, with the support of the South African Heritage Resources Agency. One of the sites is at Cape Recife in Port Elizabeth, another is at Cape St Francis and another is near Tsitsikamma. The fish traps are



Senior lecturer Donald Flint and students from the School of Architecture during the site survey of the fish-traps in Cape Recife, Port Elizabeth. Photo: Magda Minguzzi

hand-made rock walls strategically designed to work with the currents and tides and trap fish at high tide. There were different ways of constructing them – some were circular; others were a sequence of basins, and they would retain the fish in the bigger ones as a live “pantry”.

“These stone structures are mostly unknown to local people, they are not part of the national heritage sites and are not officially recognised as being related to the indigenous people of southern Africa,” says Dr Minguzzi.

Another part of the project takes the team to the Hofmeyr district of the Karoo, where master’s student Qhamani Dukada is researching precolonial Khoisan heritage related to architecture, indigenous values and landscape restoration, with reference to a site rich in rock paintings dating back thousands of years. “There are traces of rock inscriptions (commonly known as rock art) in the area with wonderful narrations of people meeting



KhoiSan Chiefs during the ceremony/international art performance “The Spirit of Water” at Cape Recife. Photo: Glenn Meyer

each other, scenes with animals like eland, and of the hunting of animals; very complex and fascinating narration.”

The research includes recording the oral stories of elderly Khoisan people, with the assistance of Nelson Mandela University student Lee-Ola Prince, who is helping with the translation of the interviews, which are usually in Afrikaans. “It’s a very important way of engaging a young person from the community and exposing her to her culture.”

In 2017, a short film titled *Spirit of the Water* was produced by Nelson Mandela University and directed by Dr Minguzzi in collaboration with the coordinators of the Khoisan community of the Eastern Cape, Chief Margaret Coetzee and Chief Xam #Gaob Maleiba. In the film, representatives of the Khoisan people performed ancient rituals at the fish traps at Cape Recife, paying homage to a time when human beings were in harmony with the earth and the ocean.

The film has since been screened at several international exhibitions and workshops, and was shortlisted in 2019 by the National Institute for the Humanities and Social Sciences as one of the three best film projects in South Africa in the category “Creative Collections: International Art Project and Performance”. An interview with Dr Minguzzi about *Spirit of the Water* is now part of the online courses programme at the University of Southampton, UK.

Dr Minguzzi says that by the end of the three-year NRF funding process, in addition to a series of publications and travelling exhibitions, the project will establish the first archive on the cultural heritage of the first indigenous peoples in the Eastern Cape, co-authored with the Khoisan chiefs.

Collaborative, Inspired Creative Spirit

2019 was a dynamic year for David Bester who performed in over 30 concerts, including three sold-out recitals at the National Arts Festival.

“The 2019 performances enabled me to explore and document new musical ideas and means of expression shared in moments of meaningful connection with audiences,” says David Bester, senior lecturer in violin and viola, and Director, Nelson Mandela University String Ensemble.

He contributed to the ground-breaking soundtrack of South African film *Moffie*; performed Messiaen’s monumental *Quartet for the End of Time*; and collaborated with award-winning guitarist James Grace in a project that explores connections between Italian, South American, and southern African music traditions.

Bester’s creative projects also served as a platform for engagement. As concertmaster for the Eastern Cape Philharmonic Orchestra, guest concertmaster for the Free State Symphony Orchestra, visiting artist at the University of the Free State, artist in residence at Kingswood College (Makhanda), and professor at the Xiquitsi music project in Maputo, Mozambique, he presented workshops and masterclasses for string teachers and players from various communities throughout 2019. “Through the sharing of knowledge, these activities have helped foster a collaborative spirit and a sense of community among local string players and their teachers.”

The Nelson Mandela University String Ensemble (NMUSE), Bester’s “passion project”, straddles both creative output and engagement, strengthening the music department’s relationship with the region’s community of practitioners. Comprising string students, teachers, and both amateur and professional musicians in Port Elizabeth, NMUSE provides a space where students can work alongside professional string players and learn in action.

In 2019, the string ensemble excelled as a vehicle for creative output. “NMUSE’s stellar performance at the *Soirée Musicale* concert in April stands out as a highlight of the year. They delivered a demanding programme, which included a world premiere and collaborations with, among others, the Nelson Mandela University Choir. This created the opportunity for students such as counter-tenor Olesegun Solyemi, to perform as soloist with live string orchestra accompaniment,” says Bester.

He concludes, “The overwhelmingly positive and enthusiastic public response to NMUSE’s success is rewarding. However, seeing students empower themselves through the experience gained in this space is what truly inspires and drives my creative energy.”



David Bester

“During 2019, they concluded the first scientific site surveys at precolonial fish traps located along the Eastern Cape coast, with the support of the South African Heritage Resources Agency.”

Because in Essence it is All Just Fabricated

In 2019, for the first time, creative outputs qualified for subsidy from the Department of Higher Education and Training (DHET).

Professor Heidi Saayman Hattingh, from the School of Visual Arts, received the 2019 Creative Output Award for photography.

Prof Saayman Hattingh's 2018 end of year exhibition, *SITE – Engaging the Archive*, at the University's Bird Street Gallery, was submitted as part of her second creative output doctorate. Her first looked at the South African photojournalist in the '80s and '90s.



Prof Heidi Saayman Hattingh

"This time I decided to bring the research closer to home and to look at something that made me look at myself and my own cultural identity within the larger diaspora," she explains.

It started with her great-aunt Mollie's photography. Mollie had started taking photographs of herself when she was still a teenager and had aspirations to be a famous actress; she would, for example, dress up and refer to herself as "Folly Mollie" in reference to *The Follies*, a theatrical revue popular in America and Britain at the time.

In the 1920s, Mollie married and lived with her husband on a trading post in the Transkei. "Here was this person living on a rural trading station in South Africa identifying with a culture that came from another continent in the form of magazines, travelling troupes of dancers and bioscopes that would set up in the smallest outposts. And so, even in the most remote spaces it culturally linked and reinforced the Britishness of a sector of white South Africans in South Africa."



"I started looking at the photographs to engage visually and aesthetically not only with the people in the photographs but, importantly, with the background and small elements in the images that revealed a lot about where and how they lived."



Top and bottom: Prof Saayman Hattingh's exhibition, *SITE – Engaging the Archive*, at the University's Bird Street Gallery

Prof Saayman Hattingh's direct link was through family photos of holidays with Mollie's family.

"I started looking at the photographs to engage visually and aesthetically not only with the people in the photographs but, importantly, with the background and small elements in the images that revealed a lot about where and how they lived.

"My research looked at how, in my heritage, white South African women identified themselves in the 1920s. Through my exhibition I wanted to see how this impacted men and women of every culture and identity. For some it was an uncomfortable space, for others it

was a space where they found themselves, or parts of themselves; for me it's a bit of both. Ultimately it revealed how we are culturally 'made', the work explores the process of how we 'acquire' identity. In essence, culture and identity are not fixed, they are conceived by people and entrenched over time.

"My exhibition created a space between spaces to encourage people to think differently. When you are faced with how identity is put together, you think about yourself and perhaps start to think about what is lived experience and what is cultural expectation. It challenged the viewer to question their 'normal' because, in essence, it is all just fabricated."

The History and Resistance of Ordinary People

Professor Janet Cherry's book *The Blot on the Landscape and Centre of Resistance – A Social and Economic History of Korsten* records the agency of ordinary people in the history of resistance in the Eastern Cape.

In the mid 1980s, Prof Cherry started investigating the history of the Korsten area in Port Elizabeth and its destruction by the apartheid state. The mid-50s saw approximately 45 000 African residents of Korsten being forcibly removed to Kwazakhele and New Brighton townships.

Her research formed the basis of the honours degree for which she registered while in prison for political activism during the mid-eighties. "This research was thus a product of the struggle, and my attempts to make sense of that time through understanding the struggles of the past," says Prof Cherry, Head of the Department of Development Studies.



Prof Janet Cherry

Thirty years later, on 30 October 2018, her book was launched at the Archives and Exhibitions Centre, 2nd Avenue Campus.

Prof Cherry's approach was to write up the history of struggle in Port Elizabeth from the perspective of reclaiming history "from below". One aspect of this is a 'gendered' history of the struggle, and the role of women in South African history.

"I was honoured to interview the late Govan Mbeki, who was released in 1987 from Robben Island, for this research project," says Prof Cherry. "His insights into class divisions in Korsten are central to the conclusions reached. I am indebted to him and to others who assisted me in this research, in particular veteran activists, the late Hilda Tshaka and the late Simon Mkalipi.

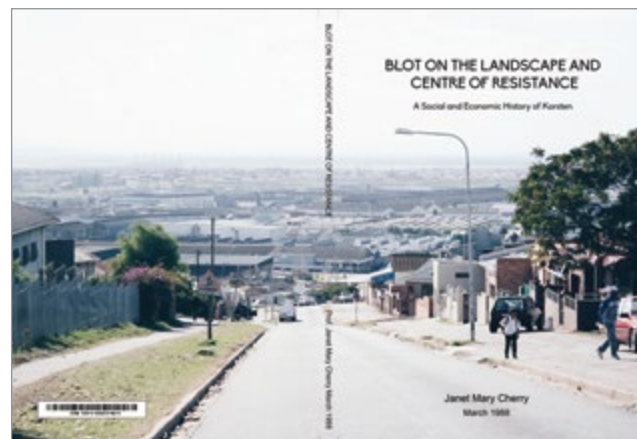
"These days we often hear the lament 'we must capture the voice of the veterans of the struggle before it is too late', and I am proud to have captured the voices of these leaders from the 1950s before they died.

"Korsten was a centre of resistance before the ANC was banned – and I argue in the book that this was one of the reasons for the removals." *The Blot on the Landscape and Centre of Resistance – A Social and Economic History of Korsten* is an account of the organisation and struggle of ordinary people and is a contribution to the history of resistance in South Africa.

The research into Korsten deepened Prof Cherry's interest in Kwazakhele township, which became the subject of her PhD thesis and ongoing research projects "involving the agency of ordinary people in making their own history and determining their own development".



"I was honoured to interview the late Govan Mbeki ... His insights into class divisions in Korsten are central to the conclusions reached."



Computer science student Challeng Makondo playing TANKS with learners in Motherwell. Photo: Mthobeli Moni

TANKS Coding Game Triumphs

Within the context of the Fourth Industrial Revolution and the scarcity of software skills in South Africa, it is important to introduce learners to coding at a young age.

"There's a desperate shortage of developers, not just in our country, but in the world. Without access to computers, the majority of South African learners cannot take advantage of this and pursue software development as a career option," says Professor Jean Greyling of the Department of Computing Sciences.

To overcome this, in 2017, computing sciences honours student, Byron Batteson, developed an educational, entertaining, mobile application game called TANKS. "TANKS allows us to go into schools that have no computers, to build a code with one smartphone and customised puzzle pieces," says Prof Greyling.

TANKS has 35 levels, and learners need to get the tank through each level to the final destination. The player uses the physical puzzle pieces to build each of the code levels. Once a particular level has been correctly pieced together, the learners use the smartphone's camera to upload a photo of it and the tank can then be moved to the next one. By the time learners reach level 35, they have learnt the basic concepts of coding, and the computing sciences team can talk to them about computer science as a career. To date, over 20 000 learners have learnt how to code this way.

In 2019 Prof Greyling's team developed two other apps – RANGERS and BOATS – as part of the project to introduce learners to coding without the use of a computer. BOATS allows for online tournaments and learners can participate from home. It has an

Coding engagement activities during 2019 included:

- On Mandela Day, 250 learners from 25 schools participated in a coding tournament in Port Elizabeth.
- A national TANKS project reached over 1 000 learners from 36 schools in all nine provinces. Over 30 facilitators were trained for this project.
- As part of the continental Africa Code Week project in October, over 11 000 learners in 60 local schools attended coding workshops. This was in partnership with the Mandela Bay Development Agency, and specifically the Nelson Mandela Bay Science and Technology Centre in Uitenhage.



Clockwise from top: Learners playing TANKS at a High School in Cala, rural Eastern Cape

TANKS in Paris (March 2019 for Mobile Learning Week)

Teachers from schools in the Nelson Mandela Bay Metro receiving TANKS school kits at a workshop hosted by iGems on Missionvale Campus

Photos supplied by Prof Jean Greyling

additional focus on marine pollution awareness, while RANGERS focuses on game poaching in Africa.

In July 2019, in partnership with educator Kelly Bush from Hudson Park Primary School in East London, the TANKS school kit was launched, empowering schools to start their own coding clubs, even without computer laboratories. Kits include game sets, lesson plans and instructional videos. Over 100 schools across the country have received the kits, mainly through corporate sponsorships.

In September 2019, the Department of Computing Sciences hosted a summer camp for students from Namibia, Mozambique and Germany, as part of a “Yields of Evocative Entrepreneurial approaches on Environment and Society” collaborative research project. A coding club startup (making use of TANKS) was one of the case studies for the camp. This resulted in the AfriKhaya coding club, which started offering regular coding workshops to learners from various townships in the Nelson Mandela Bay Metro.

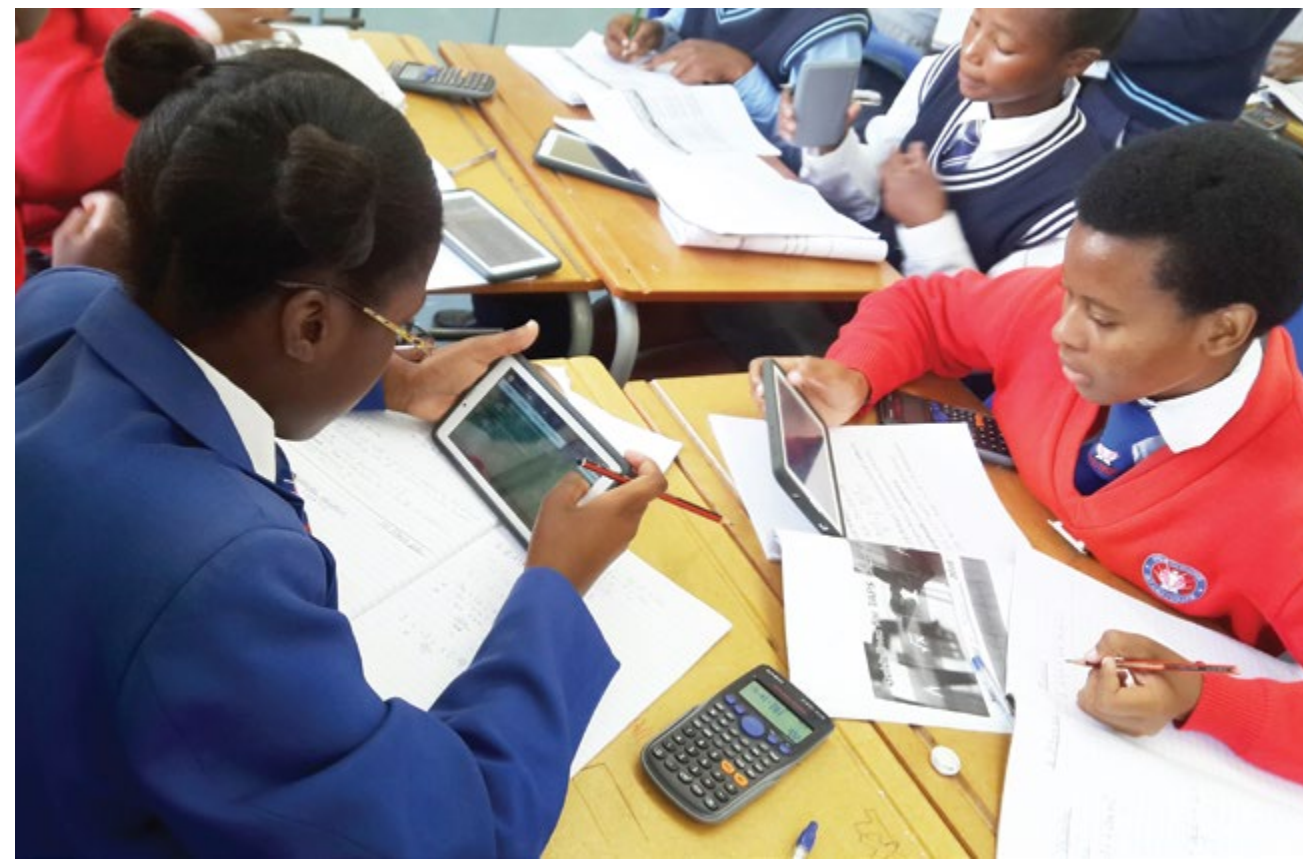
The coding project has received a number of local, national and international accolades. In March 2020, Prof Greyling was invited as a plenary speaker to UNESCO’s Mobile Learning Week in Paris. This is the United Nations’ annual flagship education event, with thousands of delegates from around the world. Unfortunately,



the day before Prof Greyling was scheduled to leave for Paris, the conference was cancelled because of COVID-19.

Accolades for the project include:

- 2019 Runner up as Technology Innovation of the Year, Africa Tech Week
- 2019 session presentation at UNESCO’s Mobile Learning Week in Paris
- Prof Greyling – Institute of Information Technology Professionals South Africa (IITPSA Eastern Cape Chapter) IT Personality of the Year
- Prof Greyling – IITPSA national finalist as IT Personality of the Year and Social Contributor
- 2019 Nelson Mandela University Innovation Excellence Award
- 2019 South African Breweries Foundation, Social Innovation Top 10 finalist.



In 2019, tablet-assisted After School Peer Support (TAPS) was offered to over 70 under-resourced secondary schools

Learners and Teachers Thrive on Techno-blended Approach

The Govan Mbeki Mathematics Development Centre (GMMDC) is successfully addressing mathematics and science challenges in under-resourced South African public schools to improve higher education access and success.

“Mathematics and science teaching in South African public schools (particularly in poor or rural areas) faces major challenges, impacting severely on skills development at the higher education level and the economic growth of the country,” says GMMDC director Professor Werner Olivier, who was a member of the Advisory Committee on Mathematics of the South African Mathematics Foundation in 2019.

“The challenges include teachers’ inadequate subject knowledge and teaching skills; the lack of school infrastructure to support modern technology-assisted approaches to teaching and learning; unreliable and costly access to the internet; low proficiency in

English; and the poverty of many home environments, which results in a lack of after-school support.”

In 2019 the GMMDC implemented a range of maths and science development and support projects. These fitted into their framework of a customised techno-blended model for schools and were supported by three complementary Android applications with interactive digital resources fully aligned with the school curriculum.

Maths and Science Learner Incubation and Support

This flagship project of the GMMDC aims at improving the self-directed learning of Grade 10 to 12 learners who show potential. In 2019, Tablet and TouchTutor® assisted maths and science incubator school programmes, facilitated by expert teachers, were offered to learners from more than 70 previously disadvantaged schools in the Eastern Cape. More than 700 selected learners benefited from

Other 2019 achievements linked to the GMMDC development programme:

- Completing a project commissioned by the Department of Basic Education to produce digital school textbooks for Life Sciences. The project formed part of a national project to provide free digital educational materials to schools.
- Establishing key partnerships with stakeholders from both the private sector and government. Apart from formal engagement project contracts with key funders, memorandums of understanding were signed with a number of universities.
- Establishing successful project partnerships and a commercialisation agreement linked to the new Gamma mobile device and GammaTutor™ software.

this programme, improving their maths and science results, and their access to higher education institutions.

Mathematics support via MobiTutorZA App for Mobile Phones

The GMMDC relaunched its innovative mobile application for Android phones in 2019 to provide additional self-directed learning support to all school learners anywhere in South Africa. This app, which is free to download from the Google Play Store, provides, inter alia, access to maths and science content, self-assessment multi-language support and school competitions.

Professional Development of in-service Teachers

In 2019 the GMMDC successfully implemented the Professional Learning Network in-service training and support programme for mathematics and physical sciences educators. A customised Technology Pedagogy and Content Knowledge model was used, to align with current educational models of learner centredness and the desegregation of science, and technology education in schools. The programme is accredited with the South African

Council for Educators and addresses the dire need for in-service upgrading of public school teachers.

GammaTutor™ Resource Centres and Support in Schools

One of the most urgent needs in the public secondary school system is flexible access to quality curriculum-aligned resources for mathematics and physical sciences. In 2019, the GMMDC established offline technology-assisted teaching and learning platforms in more than 20 under-resourced project schools and in three public libraries.

The newly developed Gamma device and GammaTutor™ software was successfully incorporated as part of these school support projects. This innovative plug and play Android device has generated great interest amongst educators and key education stakeholders at a national level. For example, new Gamma-based resource support partnerships were formed with North-West University, Walter Sisulu University and with the national Kutlwanong Maths and Science NGO programme in 2019.

Promoting STEAM Education in Schools

The engagement agenda of the GMMDC in 2019 again included a strategic focus on the promotion of Science, Technology, Engineering, Arts and Mathematics (STEAM) education in schools. This is complementary to the techno-blended education model. It represents an additional layer of engagement, supported by 4IR skills needs and key global paradigm shifts in education. Central



Self-directed learning support to all school learners. Photo: Prof Werner Olivier

to the STEAM approach is a strong focus on linking STEM subjects and arts to promote creativity in real-life problem-solving.

One of the most successful STEAM projects in 2019 was the national Math-Art competition for secondary schools. This engagement project attracted more than 600 entries from schools across eight provinces and enjoyed the full support of external partners such as the Department of Basic Education and Umalusi.



Dr Alastair Potts

Out of the Palaeoscape into the Present

“I have stepped out of the palaeoscape and into the present to try and make a difference to understanding unique biomes and conserving what we have left,” says plant ecologist Dr Alastair Potts, deputy director of the University’s African Centre for Coastal Palaeoscience (ACCP), who was awarded a National Research Foundation P-rating in 2019.

Dr Potts was drawn into the ACCP’s multi- and transdisciplinary project team to reconstruct the Palaeo-Agulhas Plain – an ancient submerged landscape along the southern Cape coastline. “It’s a long-term project to map this extinct ecosystem and to understand the resources available to early humans along this coast. Working with an outstanding team of researchers and students, we draw on neoecological skills and present-day ecology to figure out palaeoecological questions.”

“It’s exciting research, but at the same time I have interests in further understanding the present day dynamics of the Eastern

Cape’s incredible but understudied Albany Subtropical Thicket biome, which is endemic to South Africa.”

It was only described and identified as a biome in 1996, with some fantastic research done on it over the past 25 years but not nearly enough; not by a long shot. Dr Potts’ PhD was on this thicket.

“It dates back to 50 to 40 million years ago in the geological epoch called the Eocene (56 to 33 million years ago) with major herbivores driving it, including many more species of Proboscoids (animals with trunks) than we know today, namely, elephants,” Dr Potts explains. “We are down to a couple of species today but to understand how mega-herbivore systems operated 40 million years ago, this is the vegetation to look at.”

The Albany Subtropical Thicket extends from the Little Karoo in the west to the Kei river in the east to Graaff-Reinet to the north and to Eastern Cape coast in the south. “I am interested in the arid and valley forms where spekboom (*Portulacaria afra*) is a key species —

to be more precise, is an 'ecosystem engineer'. There's a trend to plant spekboom for its carbon sequestration properties, but if you take it out of its environment, its properties are lost."

Another prominent thicket species is the pruimboom (*Pappea capensis*) – one of the tree species that survives the longest after degradation. If you find it in the landscape that is where natural thicket should have occurred.

Dr Potts wants to spend time looking at thicket and thicket remnants, and filling in the gaps of the very incomplete picture of how this ancient, slow and stable biome operates. He believes the oldest trees in Africa are in this subtropical thicket and he will be searching for evidence while investigating hypotheses about its composition. "As a vegetation type, it's a museum with very ancient individuals and I want to highlight to farmers the importance of this biome in terms of its age. If you overgraze Subtropical Thicket with goats, or bulldoze it to plant watermelons or oranges, you are destroying communities where individual trees have lived side-by-side for centuries.

"We've lost a lot of it, and there is some in the Addo Elephant National Park, but it's not going to last as the density of elephants in the park is far higher than it would have been naturally when the seasonal water pans would have limited the population. I think that

Underground dune forests

"I'm also very interested in the Eastern Cape dune thickets. These are underground forests featuring a wide range of species with their main stems underground, which branch out underground and pop up side branches above the ground. They adapted like this to escape fire. We have traced one individual dune olive *Olea exasperata* for more than 50 metres underground. Our dune systems are unique, and MSc student Sinenjongo Gcina is looking at the underground tree morphology. Much of the dune thicket in Nelson Mandela University's nature reserve – which has a low vegetation height – is actually an underground forest." – Dr Potts

farmers could play a major role in conserving Subtropical Thicket by simply fencing off some of the thicket on their land (and keeping out alien invasive species). This way, they could be doing a better job of conserving this vegetation type for generations to come — more so than in Addo. I encourage farmers to do this."



An example of another underground tree species, *Euclea racemosa* – this plant architecture involves lateral branching under the ground with hundreds of vertical branches (with leaves) protruding above the soil surface. Photo: ACCP



Prof Pierre Pistorius and his research group are studying the at-sea distribution and behaviour of king penguins at sub-Antarctic Marion Island through satellite telemetry to better understand their role in the marine ecosystem and reasons for recent changes in their population numbers. Photo: MAPRU

Marine Apex Predators At Risk

The Vice-Chancellor's Researcher of the Year is Professor Pierre Pistorius, Head of the Marine Apex Predator Research Unit (MAPRU).

"In 2019 we worked on providing solutions to the poor conservation status of many marine predators. They are high up in the food chain and any changes lower down, such as increased fisheries resource extraction, have a huge impact on them," says Prof Pistorius, who has been researching marine predators – seabirds, seals, whales, dolphins and sharks – for most of his career.

"Along South Africa's coast there is big pressure on anchovy and sardine populations to support the commercial fisheries," explains Prof Pistorius. "Many of the marine predators also rely on this resource, creating competition between humans and animals. Through our work we are providing research and advice to try and mitigate some of the impact."

Climate change is another significant issue in our oceans, influencing oceanographic features and frontal systems, especially

in the Southern Ocean. Working on South Africa's Prince Edward Islands (Prince Edward Island and Marion Island), the team uses the latest tracking technology to determine how this is impacting marine predators. By attaching small electronic tags to marine predators, mostly seabirds and seals, "we can see where they are feeding, to what depth, and where they are finding prey, which identifies important foraging habitats," says Prof Pistorius.

"Seabirds are well adapted for locating feeding areas where the fish, krill or squid are and, accordingly, which are the habitats that most need to be conserved. This way we can provide well-informed advice on ecologically and biologically significant areas – areas of high productivity."

The goal is for their research on marine predators to be incorporated into fisheries management. If predators have to work harder or cannot find enough food, it means the resource is limited, which is damaging for breeding and for the entire marine food chain. Fisheries activities should then ideally be reduced until the food resource increases.



MSc Zoology student, Makabongwe Siggala with Prof Pierre Pistorius on sub-Antarctic Marion Island where Siggala spent 13 months collecting data on penguins as part of his research projects. Here they are inserting Passive Integrated Transponders in macaroni penguins to better understand changes in their population numbers. Photo: MAPRU

Prof Pistorius's team recently used tracking data to identify important seabird and marine mammal habitats around the Prince Edward Islands, which can be used to guide the expansion of the islands' Marine Protected Area. This research formed part of the Scientific Committee on Antarctic Research's *Retrospective Analysis of Antarctic Tracking Data*, which identified important habitats for conservation purposes around the entire Southern Ocean. The research also featured in an article "Tracking of marine predators to protect Southern Ocean ecosystems" in the March 2020 issue of the prestigious journal *Nature*.

"In 2019 we used miniature video cameras on a number of marine apex predators to understand the interaction between them and their prey," adds Prof Pistorius. "It has given us a really good idea about how these predators interact with the environment and the important components of their behaviour and ecology that can inform conservation."

"To offer one example, there are currently less than 20 000 breeding pairs of African penguins, down from one million. This is a major concern and the team is researching the interaction between penguins and their prey – anchovy and sardines. Other findings indicate that African penguins hunt in groups, and the decline in population numbers reduces their ability to catch prey. Looking at the larger, ecosystem level, African penguins play a really

"If predators have to work harder or cannot find enough food, it means the resource is limited, which is damaging for breeding and for the entire marine food chain."

important role in driving prey from deep waters to the surface for other seabirds. African penguins, on average, dive down between 30 and 50 metres, and can go down to 100 metres. They bring the prey up to the surface, creating bait balls for other seabirds that cannot dive down to these depths, such as shearwaters and cormorants.

"The king penguin is also at risk from climate change. The polar front is moving further away from their sub-Antarctic breeding colonies, which means the penguins have to swim longer distances, impacting on their strength and breeding ability."

Another issue relating both to climate change and to fisheries activities is the risk to albatross populations. Albatrosses can live over 50 years and have a very slow reproductive rate. Four species breed on Marion Island, but mice introduced during the seal hunting era in the late 1700s are devastating their populations. Prof Pistorius explains that climate change has led to warmer winters on the islands, leading in turn to an increase in mice, which are now feeding on live



Pierre Pistorius and Otto Whitehead (PhD student UCT) taking measurements of a rockhopper penguin on Marion Island. Photo: MAPRU

albatross chicks. The adult albatross does not have an evolutionary response to deal with this invasive predator. Advanced plans to get rid of the mice on Marion Island are temporarily on hold because of COVID-19.



Pierre Pistorius with PhD student, Rabia Ryklief, and MSc student, Jonathan Botha, on Bird Island in Algoa Bay studying Cape gannets. Photo: MAPRU

Research Awards



Researcher of the Year and Faculty Researcher of the Year

Prof Pierre Pistorius

Science

“Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, that the son of a mineworker can become the head of the mine, that a child of farm workers can become the president of a great nation. It is what we make out of what we have, not what we are given, that separates one person from another.” – Nelson Mandela



Emerging Researcher of the Year and Faculty Emerging Researcher of the Year

Dr Adeniyi Ogunlaja

Science

“If you have a passion for science and discovery, the vision continuously pulls you.”



Research Excellence Award

Prof André Keet

Research & Teaching

“Transformative research – its own re/award.”

Research Excellence Award

Prof Benita Barton

Chemistry

“To be able to empower young, inquisitive minds through education is a privilege that will never escape me.”



Faculty Researchers of the Year



Faculty Researcher of the Year

Prof Janina Wozniak

Arts

“You have to take ownership and leadership of tomorrow. For that to be possible, you have to strengthen your capacity and widen your vision as a global citizen.” Ban Ki-moon



Faculty Researcher of the Year

Dr Andrew Phiri

Business & 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

Prof John Smallwood

EBEIT

“Given that health and safety is a ‘life and death’ issue, meaningful research, and implementable recommendations, do ‘make a difference’.”



Faculty Researcher of the Year

Prof Logamurthie Athiemoolam

Education

“My research is driven by a passion to seek out new ways of knowing, new ways of doing and new ways of understanding the world.”



Faculty Researcher of the Year

Prof Ilse Truter

Health Sciences

“Never stop dreaming, and never stop being curious ... the (research) journey is as important as the destination. Enjoy the journey!”



Faculty Researcher of the Year

Prof Joanna Botha

Law

“You can’t go back and change the beginning, but you can start where you are and change the ending.” C. S. Lewis.

Faculty Emerging Researchers of the Year



Faculty Emerging Researcher of the Year

Dr Janelle Vermaak

Humanities

“Research is not scary when you’re studying something that you’re passionate about and being encouraged to create and expand knowledge.”



Faculty Emerging Researcher of the Year

Dr Felix Amoah

Business & Economic Sciences

“If I cannot eliminate the challenges confronting our societies, I can help improve the situation through my research.”



Faculty Emerging Researcher of the Year

Dr Heloise Sathorar

Education

“Research gives us the opportunity to seek ways to enhance our lives to help make the world a better place for all.”



Faculty Emerging Researcher of the Year

Dr Mark Kramer

Health Sciences

“In theory, there’s no difference between theory and practice. But, in practice, there is.” – Walter J. Savitch



Faculty Emerging Researcher of the Year

Stephen Newman

Law

“Each day is a new canvas – fill it with colour.”

Engagement Awards



Engagement Excellence Award (STEM)

Dr Tim Pittaway

Agricultural Technology Transfer Programme

“The task of the modern educator is not to cut down jungles, but to irrigate deserts.” – C.S. Lewis



Engagement Project Award

John Andrews

Architectural Engagements with Our Human

“Learning begins with something unfamiliar, or seeing something familiar from a different perspective. As an architect and teacher, I always strive to be learning.”

Engagement Excellence Team Award



Engagement Excellence Team Award

Institute for Coastal and Marine Research

“The ocean is deep within our souls; it speaks to our culture, economy and rich bio-heritage. Together, we can preserve and sustain the ocean and life.”



Engagement Excellence Team Award

Prof Veonna Goliath

The School@Home Project

“If you want to go fast, go alone; if you want to go far, go together’ – this African proverb underpins our work.”

Innovation Awards



Innovation Excellence Award

Prof Jean Greyling

“TANKS powered by TangibITM has the vision to reach thousands of learners in remote areas across our continent, introducing them to computer coding.”



Emerging Innovation Excellence Award

Dr Nicole Vorster

“I admire innovators and entrepreneurs for their contribution to society. Applied research and teaching students to be innovative have inspired me to become an entrepreneur.”



Creative Output Awards



Creative Output Award

David Bester

“Making music has opened my eyes to the immense creative power unlocked when we truly listen, look and express authentically.”



Creative Output Award

Dr Erika Bothma

“Music is my life – my life is music! Non-negotiable is a spontaneous imagination and a sense of enjoyment and delight.”



Creative Output Award

Prof Heidi Saayman-Hattingh

“What seems ordinary and everyday can reveal much about our past, our present and our possible future.”



Creative Output Award

Andrieta Wentzel

Combining design and research skills, which result in a successful collaborative and enduring artwork, provides total creative fulfilment."



Research Report Information

SURNAME, INITIALS, TITLE	RATING CATEGORY	RATING PERIOD	GENDER	RACE
ARTS (Total = 4)				
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
BUSINESS & ECONOMIC SCIENCES (Total = 6)				
Arnolds, C, Prof	C3	2014-2019	M	B
Atkinson, D, Prof	C2	2015-2020	F	W
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
EDUCATION (Total = 4)				
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
ENGINEERING, THE BUILT ENVIRONMENT & TECHNOLOGY (Total = 11)				
Abou-El-Hossein, Dr	C2	2016-2021	M	B
Botha, RA, Prof	C2	2015-2020	M	W
Emuze, FA, Prof	C3	2019-2024	M	B
Hattingh, DG, Prof	B3	2018-2023	M	W
Mostert-Phipps, N	Y2	2015-2020	F	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 Niekerk, J, Assoc Prof	C2	2014-2019	M	W
Von Solms, R, Prof	B2	2015-2020	M	W
HEALTH SCIENCES (Total = 2)				
Truter, I, Prof	C2	2017-2022	F	W
Ten Ham-Baloyi, W, Dr	Y2	2019-2024	F	W

SURNAME, INITIALS, TITLE	RATING CATEGORY	RATING PERIOD	GENDER	RACE
LAW (Total = 2)				
Govindjee, A, Prof	C2	2014-2019	M	B
Vrancken, PHG, Prof	C1	2019-2024	M	W
SCIENCE (Total = 55)				
Adams, JB, Prof	C1	2016-2021	F	W
Anandjiwala, R, Dr	C3	2019-2024	M	B
Agyingi, C, Dr	Y2	2018-2023	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	2015-2020	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
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	2015-2020	M	W
France-Jackson, H, Prof	C1	2015-2020	F	W
Fritz, H	C1	2018-2023	M	W
Frost, CL, Prof	C2	2015-2020	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
Leitch, AWR, Prof	C3	2018-2023	M	W
Little, KM, Dr	C1	2015-2020	M	W
Linol, BL, Dr	Y2	2018-2023	M	W
Lombard, A, Prof	C1	2014-2019	F	W
Marean, C, Prof	A2	2018-2023	M	W
Miranda, NAF, Dr	C3	2020-2025	M	W

SURNAME, INITIALS, TITLE	RATING CATEGORY	RATING PERIOD	GENDER	RACE
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	Y1	2019-2024	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	2015-2020	M	B
Venter, J, 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
Wagener, MC, Prof	C1	2015-2020	M	W
Watts, P, Prof	B1	2015-2020	M	W
Weigt, M, Dr	Y2	2015-2020	M	W
Wesson, JL, Prof	C2	2018-2023	F	W
Total rated researchers at Nelson Mandela University = 84			F = 29 M = 55	*B = 15 W = 69

*B (Black – as classified by NRF = Black, Coloured, Indian, Other)

Research Outputs

There has been a steady increase in the research outputs in the past three years. Notably, whereas there was a general decline in research outputs nationwide, Nelson Mandela University outputs showed an upward, improved trend.

	2015	2016	2017	2018	2019
Books and chapters	10.05	30.84	22.52	35.48	27.04
Conference proceedings	63.64	84.09	54.23	41.93	56.84
Journal articles	324.81	319.4	312.33	349.93	390.05
TOTAL	398.5	434.33	389.08	427.34	473.93

*2019 numbers are still preliminary and await final approval by the Department of Higher Education and Training.

Postdoctoral fellows: Trends over the past 4 years

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

Grants

National Research Foundation Grants for 2019: R75 090 935

Other Research Indicators

Number of research and engagement entities (institutes, units and centres)	
2019	
Centres	12
Units	7
Institutes	3
Total Research Entities	22
Technology Stations	2
Research Chairs	10
Themes	6
Rated Researchers	84

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