

The background is a collage of three images: a close-up of a hand holding wheat grains, a modern glass skyscraper, and a shanty town with a rusty corrugated metal roof. Three large, overlapping white circles are overlaid on the collage, framing the text.

RESEARCH & INNOVATION

2015-16

Research & Innovation 2015-16 is dedicated to Professor Danie Visser, deputy vice-chancellor

for research and internationalisation. He has enabled research and innovation support at the University of Cape Town to reposition and reimagine itself, enabling our researchers to face the challenges of the research landscape in the 21st century.

We thank him for his inspiring and thoughtful leadership, and his unfailing trust in us to work with him to realise his vision.

*Dr Marilet Sienaert, executive director, Research Office
Mr Piet Barnard, director, Research Contracts and Innovation*

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Message from the vice-chancellor

Dr Max Price

Adopted in September 2015, the SDGs replaced the millennium development goals (MDGs), whose remit ended in that year. The eight goals of the MDGs were drafted in the basement of the UN office in New York by a small group appointed by the UN secretary general, Ban Ki-moon (environmental sustainability was almost forgotten). By contrast, the more ambitious 17 goals of the SDGs were the result of a negotiating process between 193 countries and wide consultation with a host of stakeholders.

The resulting SDGs are wide-ranging, yet it is striking how closely they speak to critical problems for South Africa and the continent. Inequality, climate change, food and water insecurity, unemployment, safe cities – this is a script that could have been written by us.

It is also reassuring to see how closely the SDGs – the result of such wide and thorough global consultation – match the strategic priorities of research at the University of Cape Town. It is therefore no coincidence that UCT researchers were among the world-leading academics who were involved in the lobbying for and drafting of the SDGs. Professor Haroon Borhat, for instance, served as head of research for the High-level Panel appointed by Ban, to deliver a proposed SDG agenda to the UN General Assembly. Members of the African Centre for Cities (ACC) participated in a global campaign to ensure that sustainable cities were explicitly included in the SDGs (a fight that had been lost with the MDGs). They were also members of the Sustainable Development Solutions Network, led by Ban's advisor Professor Jeffrey D Sachs, which helped to shape the goals. Similarly, Professor Crick Lund was one of the leaders in the field of global mental health - #FundaMentalSDG - who lobbied to have mental health included (it was entirely missing from the MDGs).

This involvement of academics in the drafting of the SDGs has meant that the global research community is better placed to contribute to their implementation. And there is wide acceptance that they must do so if the SDGs are to succeed. One feature of the SDGs is the plethora of targets (169), the perhaps predictable result of the sprawling negotiation process. Each country will have to choose which targets to prioritise, and academics should play a role in guiding governments in this decision. The global community will also need the expertise of researchers to track the targets, and to help in the training of those who will play a part in the SDGs' implementation.

The SDGs are not perfect, and many of our researchers are the first to point this out. However, this is another key role they have to play: providing an independent and critical voice to ensure, not only that the goals are realised as closely as possible, but that their complexity is not lost in translation. *Transforming Our World: The 2030 Agenda for Sustainable Development* recognises the interconnectedness of the goals, and the increasingly interdisciplinary focus of much research at UCT means that it is well placed to play its part in finding solutions for a more sustainable world. ○

Image by Deborah Posel.



We have chosen, as the theme of this year's publication, the United Nations' (UN) sustainable development goals (SDGs). Research is crucial to achieving sustainable development and UCT is well placed to play its part.

UMyalezo ovela kuSekela Ngqonyela weYunivesithi uGq Max Price

Sikhethe, njengomxholo wolu papasho lwalo nyaka, iinjongo zophuhliso oluzinzileyo (iiSDG) zeZizwe eziManyeneyo (UN). Uphando-lwazi lubalulekile ekufezekiseni uphuhliso oluzinzileyo yaye iUCT ikwinqanaba elifanelekileyo lokokuba idlale indima yayo.

Njengokuba zamkelwa ngoSeptemba 2015, iiSDG zithabatha indawo yeenjongo zophuhliso zemileniyam (iiMDG), esinyanzeliso sazo sipele kuloo nyaka. Iinjongo ezisibhozo zeeMDG zayilelwa kwigumbi elisezantsi lesakhiwo se-ofisi ye-UN eNew York, liqelana elalityunjwe nguNobhala Jikelele we-UN, uBan Ki-moon (uzinziso lwendalo lwaluphantse lwalityalwa). Ngothekiso, uninzi lweenjongo ezili-17 zebhongo zeeSDG zingumphumela wenkqubo ekuthethweneyo ngayo, phakathi kwamazwe ali-193 kunye nothethwano ngokubanzi lwayo yonke inyambalalala echaphazelekayo.

IiSDG ezingumphumela zichaphazela imiba emininzi, kodwa okuqaqambileyo yindlela ezithetha ngayo into esondelelene kakhulu kwiingxaki ezibalulekileyo zoMzantsi Afrika kunye nelizwekazi. Ukungalingani, inguqu kwisimo sezulu, ukutya nokungakhuseleki kwamanzi, intswela-ngqesho, izixeko ezikhuselekileyo - olu luxwebhu olwalufanele ukuba malube lubhalwe sithi.

Kuyaqinisekisa ngokunjalo ukubona indlela ezisondelelene ngayo iiSDG - umphumela wothethwano lwehlabathi olubanzi olunjalo - nokubekwe phambili kwiqhinga lophando-lwazi lweYunivesithi yaseKapa. Asinguwo umnqa ngoko ukuba abaphandi baseUCT bebephakathi kwezinye iinkcuba-buchopho eziphambili zelizwe ebezibandakanyeka kwimpembelelo nakuyilo lweeSDG.

UNjng. Haroon Borat, umzekelo, usebenze njengentloko yophando-lwazi lwe **High-level Panel etyunjwe** nguBan Ki-moon, ukulungiselela ukunikezela nge-ajenda ecetywayo yeSDG kwiUN General Assembly. Amalungu eAfrican Centre for Cities (ACC) athabathe inxaxheba kwiphulo lehlabathi lokuqinisekisa ukuba uzinziso lwezixeko lubandakanyiwe ngokucacileyo kwiiSDG (iphulo elingazange liphumelele kwiiMDG). Babe ngamalungu ngokunjalo **eSustainable Development Solutions Network**, ekhokhelwa ngumcebisi kaBan Ki-moon uNjing. Jeffrey D. Sachs, athe anceda ukubumba iinjongo. Ngokufanayo, uNjing. Crick Lund ube ngomnye weenkokheli kummandla wempilo yengqondo yehlabathi - **#FundamentalSDG** - othe waphembelela into yokokuba impilo yengqondo ibandakanywe (yayingekho kwaphela kwiiMDG).

Oku kubandakanyeka kweenkcuba-buchopho kolu yilo lweeSDG, kuthetha ukuba iqela lwezophando-lwazi lwehlabathi lukwinqanaba elingcono lokuqinisekisa ukumileselwa kwazo. Yaye kukho ulwamkelo olubanzi lokokuba kufuneka lwenze njalo ukuba ngaba iiSDG zizakuphumelela. Uphawu olunye lweeSDG kukukhupha iinjongo ezijoliswe kulo (169), mhlawumbi isiphumo esilindelekileyo senkqubo exananazileyo yothethwano. Ilizwe ngalinye kuya kufuneka lenze isigqibo ngokujoliswe kulo eliya kukubeka phambili, yaye iinkcuba-buchopho kufuneka zidlale indima ekukhokheleni oorhulumente ekwenzeni isigqibo. Uluntu lwehlabathi luya kudinga ngokunjalo ubuchule lwabaphandi-lwazi ekulandeleni ekujoliswe kulo, nokunceda kuqeqesho lwabo baya kudlala indima kumilisele lweeSDG.

IiSDG azigqibelelanga, yaye uninzi lwabaphandi bethu babe ngabokuqala ukuyibeka elubala le nto. Nangona kunjalo, le yenye yeendima eziphambili ekufaneleke ukuba bazidlale: ukunikezela ngezwi elizimeleyo nelifanelakileyo ukuqinisekisa hayi kuphela ngento yokuba iinjongo ziyafezekiswa ngokusondele kakhulu, kodwa nento yokuba ubumbaxa bazo abulahleki kwinguqulelo. [Ukugququlwa kweHlabathi Lethu: I-Ajenda ka 2030 elungiselelwe uPhuhliso oluZinzileyo] kunika ingqwalasela kukuhlangana kweenjongo, kunye nengqiqo eyandileyo yophando-lwazi oluninzi eUCT kuthetha ukuba ikwinqanaba elifanelekileyo lokuthabatha inxaxheba ekufumaneni izisombululo zokuzinziswa kwehlabathi. ○



Boodskap van die vise-kanselier

Dr Max Price

As tema vir hierdie jaar se navorsingsverslag het ons die Verenigde Nasies (VN) se Volhoubare Ontwikkelingsdoelwitte (VOD's) gekies. Navorsing is noodsaaklik om die doelwitte van volhoubare ontwikkeling te bereik, en die Universiteit van Kaapstad is goed geplaas om hiertoe by te dra.



Die VOD's wat in September 2015 aanvaar is, het die Millennium-**Ontwikkelingsdoelwitte** (MOD's) vervang wat daardie jaar verstryk het. Die agt doelwitte van die MOD's is in die kelderverdieping van die VN se kantore in New York geformuleer deur 'n klein groepie wat aangestel is deur die VN se sekretaris-generaal, Ban Ki-moon (omgewingsbewing is byna **vergeet**). In teenstelling hiermee is die meer ambisieuse 17 doelstellings van die VOD's die resultaat van 'n onderhandelingsproses tussen 193 lande wat wye konsultasie met 'n groot aantal belanghebbendes ingesluit het.

Die VOD's wat gevolglik bepaal is, is verreikend, en die sterk aanklank met kritieke probleme vir Suid-Afrika en die kontinent is besonder opvallend. Ongelykheid, klimaatsverandering, die onsekere toekoms van die voedsel- en watervoorraad, werkloosheid, veilige stede – dit is 'n draaiboek wat deur ons geskryf sou kon word.

Dit is ook gerusstellend om te let op die noue verband tussen die VOD's – wat die resultaat was van so veel wye en deeglike konsultasie- en die Universiteit van Kaapstad se strategiese navorsingsprioriteite. Dit is dus geen toeval dat navorsers van die UK deel van die wêreldspan voorste akademici was wat betrokke was by die veldtog vir, en formulering van, die VOD's nie. Professor Haroon Borhat, byvoorbeeld, het gedien as hoof van navorsing vir die **paneel van top-deskundiges** wat aangestel is deur Ban, om 'n VOD-agenda voor te stel vir die VN se Algemene Vergadering. Lede van die *African Centre for Cities* (ACC) het deelgeneem aan 'n wêreldwye veldtog om seker te maak volhoubare stede is eksplisiet ingesluit by die VOD's ('n stryd wat tevergeefs gestry is tydens die ontwikkeling van die MOD's). Hulle was ook deel van die **Volhoubare Ontwikkelingsoplossings-netwerk**, wat gelei is deur Ban se raadgewer, professor Jeffrey D. Sachs, en wat rigting gegee het aan die ontwikkeling van die doelstellings. So ook was Professor Crick Lund een van die leiers in die veld van wêreldwye geestesgesondheid (**#FundamentalSDG**) – wat druk uitgeoefen het om geestesgesondheid in te sluit (dit was glad nie deel van die MOD's nie).

Die betrokkenheid van akademici in die formulering van die VOD's het beteken dat die wêreldwye navorsingsgemeenskap in 'n beter posisie is om by te dra tot die implementering daarvan. En dit word algemeen aanvaar dat hulle dit móét doen om die VOD's 'n sukses te maak. Een kenmerk van die VOD's is die oorfloed van doelwitte (169) – dalk 'n voorspelbare gevolg van die onderhandelingsproses. Elke land sal moet besluit watter doelwitte om te prioriseer, en akademici behoort hierin 'n rol te speel deur leiding te gee aan regerings in die maak van hierdie keuses. Die wêreldgemeenskap sal ook die kennis

van navorsers benodig om die doelwitte te monitor en om te help met die opleiding van dié wat 'n rol sal speel in die uitvoering van die VOD's.

Die VOD's is nie perfek nie, en baie van ons navorsers is gou om daarop te wys. Hierdie onafhanklike en kritiese stem van akademici speel 'n belangrike rol om seker te maak dat die doelstellings 'n werklikheid word, en dat kompleksiteit nie verlore raak in die uitvoering daarvan nie. *Transforming Our World: The 2030 Agenda for Sustainable Development* erken dat daar raakpunte is tussen die doelstellings, en die toenemend interdisiplinêre fokus van so veel van UK se navorsing beteken dat die universiteit in 'n sterk posisie is om by te dra tot oplossings vir 'n meer volhoubare wêreld. ○

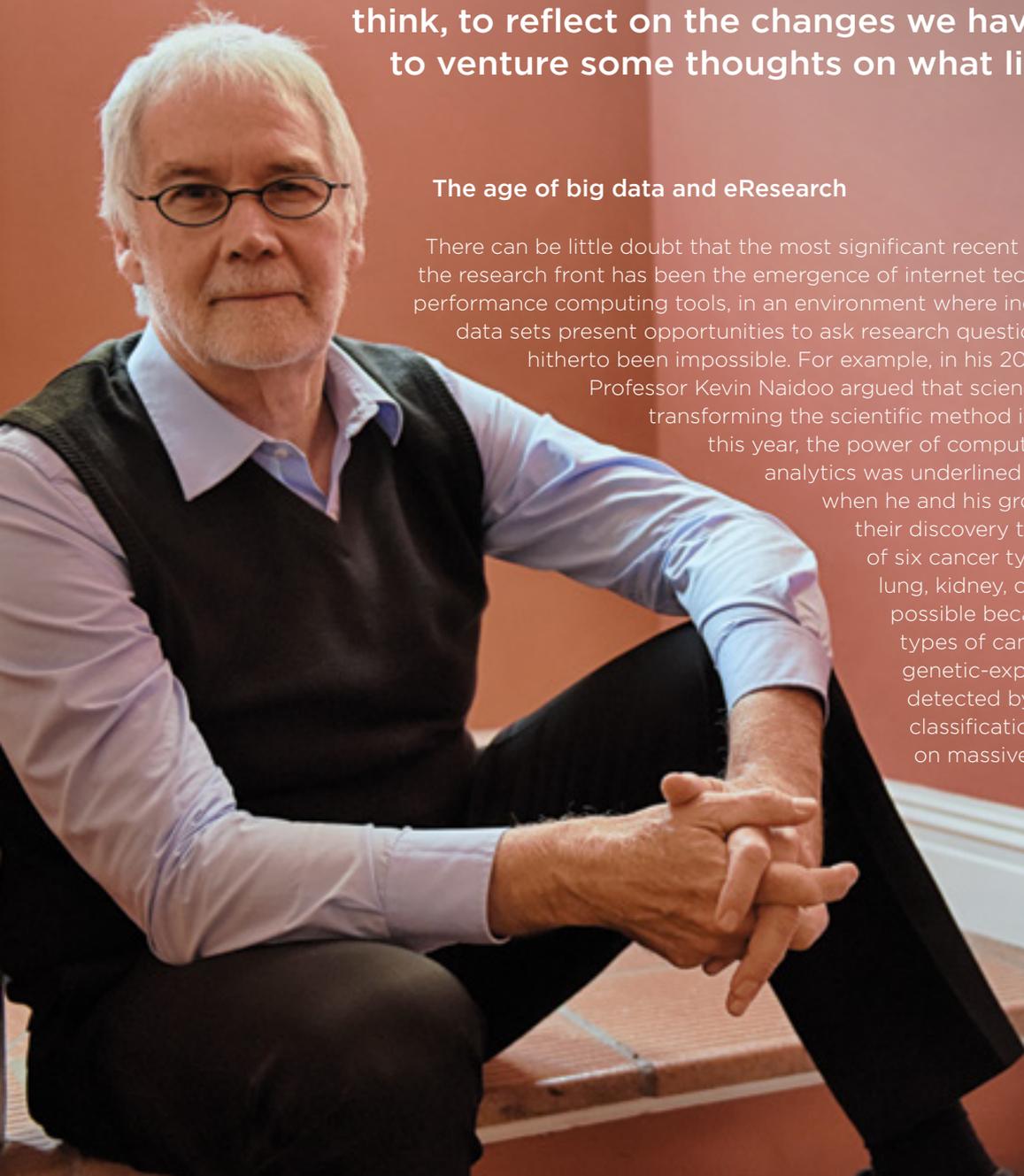
The changing research landscape: past and future

**Professor Danie Visser,
deputy vice-chancellor**

This is the ninth and final time that I have the privilege to write an introduction for the annual report on research at UCT. The past decade has seen significant shifts in the international and local research landscape, and the next decade poses some impressively difficult challenges for research-intensive universities. My last research report is a good opportunity, I think, to reflect on the changes we have seen, and to venture some thoughts on what lies ahead.

The age of big data and eResearch

There can be little doubt that the most significant recent development on the research front has been the emergence of internet technology and high-performance computing tools, in an environment where increasingly massive data sets present opportunities to ask research questions that have hitherto been impossible. For example, in his 2012 inaugural lecture Professor Kevin Naidoo argued that scientific computing is transforming the scientific method itself – and in May this year, the power of computational big-data analytics was underlined in emphatic fashion when he and his group announced their discovery that early diagnosis of six cancer types (breast, colon, lung, kidney, ovarian and brain) is possible because each of these types of cancer has a unique genetic-expression pattern, detected by using statistical classification algorithms on massive tumour gene-expression data.



With the building of the world's largest radio telescope, the Square Kilometre Array (SKA), near Carnarvon in the Northern Cape, astronomy is set to become the most data-intensive of all disciplines. This instrument – the first phase of which is currently being built in order to better understand such things as the origins of the universe, whether we are alone in it, and what the invisible and mysterious dark matter and dark energy really are – will deliver data unprecedented in volume, velocity and complexity. UCT is intimately involved in this project, and in astronomy generally; and with the University of the Western Cape (UWC), North-West University (NWU) and the University of Pretoria (UP), we have created the Inter-University Institute for Data-Intensive Astronomy (IDIA) to ensure that the data will not merely be exported (like our unbeneficiated iron ore), but that South African scientists can participate in the science that will flow from this data. This institute also has the brief to be a resource for all the other disciplines involved in data-intensive research, such as bio-informatics, high-energy physics, climate modelling, fluid dynamics, digital humanities and many more.

Globally, the new world of data-intensive research has led to the emergence of dedicated centres to guide researchers into the amazing possibilities of this new way of doing research – and UCT has taken the lead in this country, by establishing South Africa's first eResearch centre. UCT and its partners in IDIA have also invested significantly in providing the cyberinfrastructure necessary for this kind of research, and this investment has been boosted by the Department of Science and Technology (DST) recently approving a proposal by a Western Cape consortium of institutions, led by UCT, to establish a data-centric high-performance computing facility, known as the Western Cape Data-Intensive Research Facility (DIRF), as part of the DST's National Integrated CyberInfrastructure System (NICIS). Nowadays, some data can only be understood if it can be visualised – and visualised *big* – and so we have invested in some exciting, advanced visualisation tools, such as UCT eResearch's video wall erected in the Oppenheimer Library, and the upgrade of the planetarium, in which we participated with the DST, the National Lotteries Commission, and our sister universities in the Western Cape; the Digital Planetarium will be a world-class scientific visualisation facility that can be used to study data in astronomy and many other disciplines.



The doors of learning shall be opened: open access

Another hot wind of change blowing through the international research landscape is that of the open-access movement. UCT, having signed the Berlin Declaration on Open Access to the Sciences and Humanities in 2011, formally adopted an open-access policy in 2014, giving effect to its obligations under this declaration to make this scholarship “discoverable, visible and freely available online to anyone who seeks it”. UCT Libraries are the custodians of the policy, and through their Research Data Management Services, and working with UCT eResearch, provide the training and back-up to make the university's research (and the data on which it is based) increasingly open to all. The international fight to break the chains that currently tie down scientific communication is a very difficult one (about which more below); but the gains are so important to the future of research that it is every university's duty to wage it until the goal is achieved.

Crossing the borders between disciplines

The reaction against the hard-wiring of universities to disciplinary research has gained increasing momentum since 2004, when the US National Academies released their report *Facilitating Interdisciplinary Research*. As evidence mounts that the really big questions facing the world – climate change, energy, poverty and disease – will only find answers if they are not approached with a narrow perspective, UCT has responded to this international trend, first by launching five interdisciplinary initiatives in 2007 – labelled Signature Themes: the African Centre for Cities, the Drug Discovery and Development Centre (H3D), the Minerals to Metals Research Centre, the Brain and Behaviour Initiative, and the Marine Research Institute (Ma-Re); secondly, in 2009, by launching a number of Vice-Chancellor’s Initiatives, aimed at interdisciplinary solutions to the most important challenges facing our country: the African Climate and Development Initiative (ACDI), the Poverty and Inequality Initiative (PII), the Safety and Violence Initiative (SAVI) and the Schools Improvement Initiative (SII); and thirdly, in 2015, by launching five new interdisciplinary institutes (Neuroscience, Future Water, Human-Wildlife, Safety Governance, and Democracy, Citizenship and Public Policy in Africa).

Meanwhile, a university research committee (URC) task team on inter- and transdisciplinarity has made good progress in working on proposals for improved governance and funding of interdisciplinary research.

Erasing borders between countries

In our Research Strategy 2015 to 2025 we affirm the central importance of international co-operation in the production of high-impact research; and to this end, we have both supported existing bottom-up international linkages of researchers and research groupings, and judiciously extended our networks on the continent and further afield to create opportunities for new collaborative work. In both instances, we have been open to the world, but especially mindful that we want to be open to our own continent to give expression to our Afropolitan vision.

For example, we have negotiated joint doctorates in a number of areas to further strengthen existing bonds; we have championed three-cornered partnerships between ourselves, our African partners and our joint partners in the global north; and we have worked with a large number of our researchers to enter into agreements that empower their research efforts.

We are a member of various networks, the principal examples being the *Worldwide Universities Network* (WUN), an active, global network concentrating on enabling research; the African Research Universities

Alliance (ARUA), a network of 16 African universities created to advocate for the strengthening of research and postgraduate training on the continent; and the *International Alliance of Research Universities* (IARU), a network of 11 research universities spread out across the world, working together to improve all aspects of their performance. In order to be more effective in our service delivery, we have increasingly combined the efforts of the *International Academic Programmes Office* (IAPO) and the *Research Office* in order to align our international partnerships with our research mission.

Ethics

In 2010, we began creating an office of research integrity. We rewrote all the policies on research ethics in an extensive consultative process, and the *Office of Research Integrity* (ORI) was established and a director appointed. Through the tremendous efforts of its interim director in 2010 and 2011, and thereafter through its first director, this office has lifted the standard of compliance with ethical standards to a wholly new level.

Innovation

Universities constantly produce a rich stream of ideas and discoveries; more and more, universities recognise the importance of inspiring their researchers to see that often, the excitement of having a novel idea or making a groundbreaking discovery can be matched by finding the means to apply that idea, either for the benefit of society or as a business enterprise. Fostering an entrepreneurial spirit has therefore become a serious part of what universities do – and UCT has embraced this new way of thinking.

The *Research Contracts and Innovation* department (RC&I) has steadily expanded its operations: liaising with external bodies (such as the National Intellectual Property Management Office and the Technology Innovation Agency); informing, mentoring and supporting inventors and innovators; stimulating commercialisation through active advice, early funding and assistance in seeking external funding; and communicating commercialisation opportunities, through publications such as the annual *Innovation at UCT* report and the ‘Café Scientifique’ talk series. We have also established an *Institute of Design Thinking* (d-School), funded by the Hasso Plattner Foundation, along the lines of the d-Schools at Stanford and Potsdam universities. Its purpose is to instil creative thinking, by bringing people from different disciplines together and giving them (as the Stanford Design Institute puts it) “spectacularly transformative learning experiences ... to develop a process for producing creative solutions to even the most complex challenges they tackle”.

At the Graduate School of Business, we have established the Bertha Centre for Social Innovation and Entrepreneurship; and recently we produced a massive open online course: 'Becoming a Changemaker: introduction to social innovation' (led by Francois Bonnici, director of the Bertha Centre).

All these interventions combine to instil an expanding spirit of confidence that UCT is a place where solutions to even the most difficult problems are made possible.

Supporting research

Our Research Strategy 2015 to 2025 commits us to continuing to develop the capacity to support researchers at every level, through a variety of mechanisms. The Research Office has a justified reputation for providing a very high level of support to emerging researchers through its Emerging Researcher Programme, the programmes presented by the Postgraduate Studies Office and the facilities in the Postgraduate Centre and Funding Office, working with UCT Libraries and the Centre for Higher Education Development (CHED).

The actual business of enabling research – applying for grants, entering into contracts and ensuring compliance with the terms of the grants – has received a massive boost in that the university has invested in the Converis system, which is currently being rolled out and is intended to deliver 21st-century technology-enabled support to researchers during all the stages of the research endeavour.

The future

What does the future hold for research at UCT? There are important challenges to be overcome; but if we do overcome them, research at UCT will reach even greater heights than it has scaled up to now. What are these challenges?

One of the most important things that distinguishes UCT is its character as a research-intensive university. The central challenge for research-intensive universities in South Africa in the immediate future will be to convince all stakeholders – including government – that they are essential elements of prosperity and well-being in any country.

This is accepted in many developing and developed countries, and everywhere this insight is translated into funding regimes that enable these universities to fulfil their mission – but not yet in South Africa. There

are obvious reasons why this issue is sensitive in South Africa, since the privileging of research-led universities can easily be seen as a mere continuation of past unfair advantage.

A constant theme of my custodianship of the portfolio for promoting and enhancing research at UCT has been that UCT must strive to be a brilliant example of a university in the developing world, which means that it must both contribute to answering the big



science questions, *and* respond meaningfully to solving the problems that face the country and the region. I am proud to say that UCT has evolved - naturally, and not because of my exhortations - into such a university: the excellent science that we have always done has increasingly been infused with a mission to be engaged with the communities that we serve in our city, country and continent, and to direct our efforts towards responding to their needs.

Browsing through this report, I think, proves this claim beyond any doubt; but our immediate task is to communicate effectively how we serve our country with everything that we do. And importantly, to show - by transforming ourselves into a university that truly is representative of and serves all the people of our country - that investment in us is a good thing.

This leads to the next part of the challenge that the immediate future poses: research-intensive universities are expensive, and, although an important part of the task of making the case for such universities is to argue for the necessary level of investment - in people, infrastructure and equipment - we should not only work for an appropriate investment in research universities: we should also stand up to those who exploit universities. Here I have in mind the big publishing houses, who by securing rights over multiple electronically-available journals, have become the pirates of the 21st century, exacting huge harvests where they have hardly sown.

This is a battle that has begun: there remains a lot to be done, but it is picking up momentum, and we can say that we are at least at the end of the beginning.

The importance of this advocacy role for securing our future cannot be overstated, but we must also face the fact that in the end, most research is paid for by outside grants. Therefore, we must become increasingly adept at securing research grants, and be prepared to prioritise our own resources to support research that cannot be funded by grants. This is the task of internal advocacy - we must be able to demonstrate that appropriate cost-recovery is a good and necessary thing, because it is used to provide services that enable research and make the work of researchers more effective.

I would like to thank all my wonderful colleagues in the Research Office (including the Postgraduate Funding Office and the Office of Postgraduate Studies), in Research Contracts and Innovation,



and in the International Academic Programmes Office for the superb support that I have received over the years and for the great work that each and every member of these offices do each day for our university. It has been an enormous privilege to serve with you. It is also a great pleasure to extend a warm welcome to my successor, Professor Kgethi Pakeng, and to wish her every success for the important work that lies ahead. ○

Portrait of Danie Visser by Michael Hammond. Images on page 8 by DARPA, Wikimedia Commons and Ecole polytechnique Université Paris-Saclay, Flickr. All other images by Michael Hammond.

Professor Mamokgethi Phakeng: young people come first, says incoming DVC

Having started school under a tree in Marapyane village in Mpumalanga, Mamokgethi Phakeng never envisaged herself as a professor; there was no role model to fire her imagination or kindle a desire.



It's not that she didn't have fine role models growing up, says UCT's incoming deputy vice-chancellor (research and internationalisation), a respected mathematics education scholar who joined the university on 1 July 2016 ahead of incumbent DVC Professor Danie Visser's retirement in December. Her mother, Wendy, went back to school (in uniform) to do grade 7 after she'd had three children (Mamokgethi is the second).

"I was encouraged by my late father, Frank Lentsoe Mmutlana, who was high-school educated and wanted my mother to continue her education. Education was a priority at home, mainly because of my dad. I was just so happy that she studied with us and helped me with my homework!" Phakeng excelled academically, majoring in mathematics at the University of Bophuthatswana (now part of North-West University). It was a language she understood and loved.

As a student sitting at a coffee shop or waiting for her next lecture, Phakeng would scribble theorem proofs on her denim jeans and backpack. "I was truly a boring chick – no parties and no boyfriends," she recalled. "I spent time in the library or playing sport. I was not date-able." But it wasn't all work; in that time, Phakeng represented her university as a ballroom and Latin American dancer ("If there's a good partner in the room I can still get to the floor.").

Her bachelor's degree led her to the University of the Witwatersrand for postgraduate study and a doctorate in 2002, when she became the first black African woman in South Africa with a PhD in mathematics education, "which tells you what the state of maths education was back then," says the 49-year-old mother, stepmother and adoptive mother of five. ○

Research and transformation

In Sweden for a conference when the news of her UCT appointment was announced in January, Phakeng, then vice-principal of research and

innovation at the University of South Africa (UNISA), was upbeat about her new job. "Given what UCT is, my view is that the university should be the go-to place when it comes to relevant, responsive research that contributes to the growth and wellbeing of the country and continent.

"I hope to consolidate and sustain that [UCT's] performance while transforming the cohort of researchers to ensure we don't only lead when it comes to research productivity and influence, but also when it comes to researching transformation and transforming research." Phakeng is working alongside Visser for the first six months, to get to know the turf, "important because it will help me serve better".

The decision to move south and make her academic home at UCT was also made easier by timing. "My term at UNISA was coming to an end and I needed a different experience, a new challenge."

Milestones

A National Research Foundation B2-rated researcher (with plenty of publications and citations in her area of research), Phakeng regards the rating as her best academic achievement to date. "It came only 10 years after my PhD." The achievement is set against a backdrop of several other important research and community work awards.

The big one is the 2011 National Science and Technology Forum award for innovative research on teaching and learning mathematics in multilingual classrooms. In 2013, CEO magazine called her the most influential woman in education and training in South Africa and in 2014, she was named the Most Influential Woman in Academia in Africa.

Those who have met Phakeng talk of her enthusiasm, energy and personal style. It's a particularly charismatic combination for young people and it's the youth with their teeming ideas and get-up-and-go attitude that inspire her.

"Young people come first for me; some remind me of myself many years ago and others give me hope. They are our future." She's very active on social media and welcomes any platform to engage with them – the more interactive the communication, the better. Besides people and ideas, causes absorb her.

Phakeng started the Adopt-a-learner Foundation in 2004 to ensure that gifted young black people in

townships and rural areas aren't lost to the country. "I started the foundation because being the first to achieve anything is a responsibility to ensure that one is not the last," she added. "Human capital development is at the centre of what I do – all of my initiatives are about developing people and inspiring them to be the best in whatever they choose to be."

Transformation and education

Reflecting on the sharp advent in 2015 and continuation of student activism around inclusive and free higher education, Phakeng said the #FeesMustFall campaign signalled opportunity and danger. "It may be the beginning of the rise, or fall, of South African public higher education as we know it.

"Depending on how government responds, we may see the emergence of a stronger private higher education sector and thus the beginning of a thriving parallel higher education system like the one we have in basic education: one for the poor and the other for the rich. This is undesirable." She added: "The #FeesMustFall campaign is about free education for all, which is essentially about ensuring that higher education is not commodified. The government's response, however, is about free education for the poor through NSFAS, which suggests that those who can afford it must pay.

"My concern is that while the government has increased NSFAS funding and given additional money to universities to deal with the 0% increase in fees for 2016, it is not responding to the real issue that the students are raising – ending the commodification of public higher education." But more than that, it's also about basic education, says Phakeng. "We need a plan or road map that indicates how we can achieve free education for all in South Africa. Such a plan should start by immediately ensuring free education for the poor at all levels. We also need a study that investigates the success and limitations of the no-fee schools since inception in 2007."

But behind her ardent support of youth and their education – and behind her own achievements – is the spectre of poverty. "The idea of 'lack' just scares me. I had enough of it as a young person and so I work hard to make sure that I never go back there – and in the process, I try to protect as many young people as I can from poverty." ○

By Helen Swingler. Image supplied.



A snapshot of research at UCT

Our vision

UCT aspires to become a premier academic meeting point between South Africa, the rest of Africa and the world. Taking advantage of expanding global networks and our distinct vantage point in Africa, we are committed, through innovative research and scholarship, to grapple with the key issues of our natural and social worlds. We are committed both to protecting and encouraging 'curiosity-driven research' and research that has a real impact on our communities and environment.

2015 - 16 WORLD UNIVERSITY RANKINGS

1st
IN AFRICA

- **120** Times Higher Education
- **171** Quacquarelli Symonds

4th
IN BRICS

Times Higher Education

SUBJECT AREA

Times Higher Education 2015/16

TOP
100



Clinical, pre-clinical and health
(63rd) and 1st in Africa



Arts and humanities
(97th) and 1st in Africa

Quacquarelli Symonds 2016

TOP
100



English language and literature



Agriculture and forestry



Education



Law



Politics and international studies



Architecture and the built environment



Medicine



Archaeology



Engineering (mineral and mining)



Anthropology

TOP
10



Development studies **(9)**

TOP
50

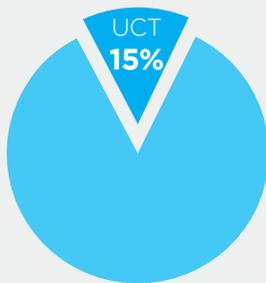


Geography **(46)**

Research performance indicators

Total research publications

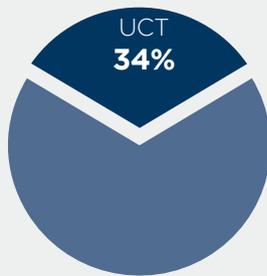
2013	2014	2015
2 640	2 873	3 041



NRF-rated researchers

The National Research Foundation allocates ratings based on a researcher's recent research outputs and impact, as perceived by international peer reviewers.

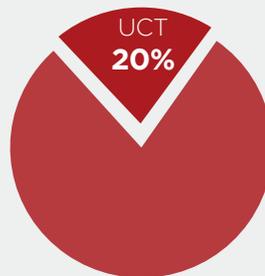
Nationally, UCT has more NRF-rated researchers (15%) than any other university in South Africa.



A-rated researchers

A-rated researchers are international leaders in their field.

Just over third of the country's A-rated researchers are at UCT.



SARCHI Chairs

Department of Science and Technology/National Research Foundation South African Research Chairs are designed to strengthen the ability of the country's universities to produce high-quality research, innovation and students.

Almost a fifth of the country's SARCHI Chairs have been awarded to UCT.

Income



2 Spin-off companies

56 Patent applications filed

In 2015

UCT received more funding in direct grants from the US National Institutes of Health (NIH) than any other research institution outside the US

2015 innovation dashboard

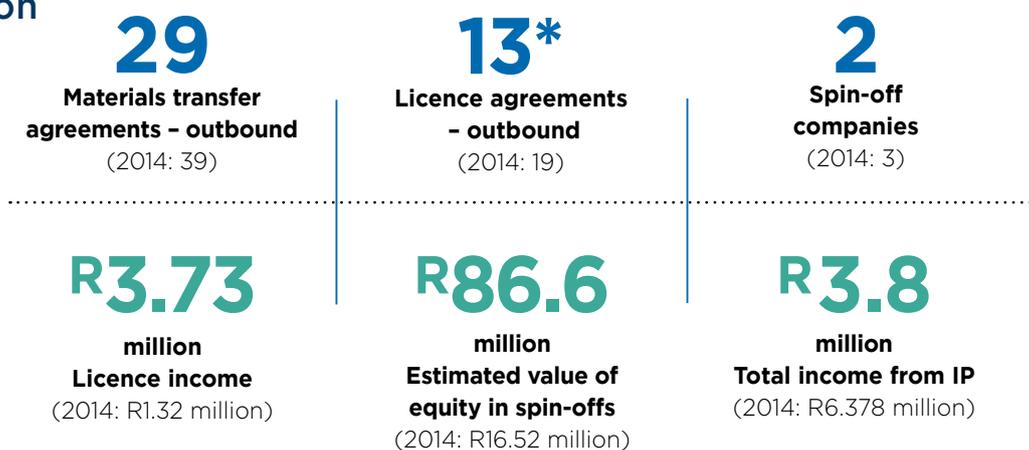
Research



Intellectual property (IP) protection



Innovation



*Includes option and assignment agreements

Spin-off companies

R86.6m

Estimated
value of UCT
equity

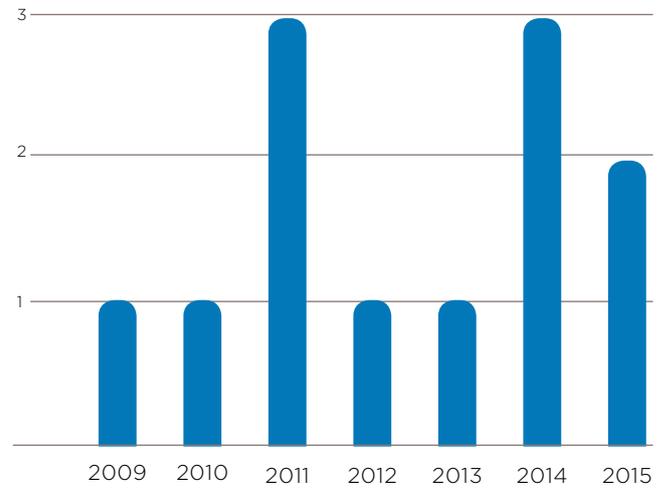
17

Spin-off
companies
2004 to 2015

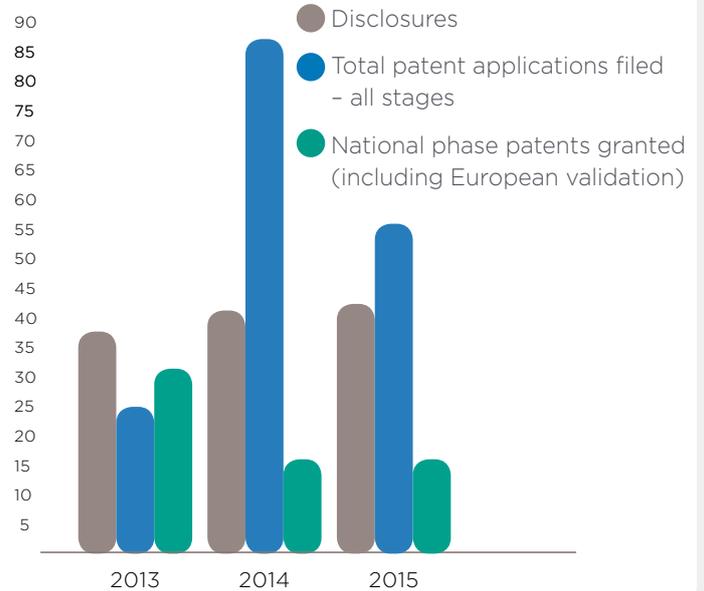
7

Total spin-off
companies in
which UCT has
equity

Number of UCT spin-offs



Annual UCT patent portfolio statistics



**2001
TO
2015**

R2 700 139 - Profit from UCT companies
R12 284 629 - Licensing
R5 687 224 - Sale of IP

Total
R20 671 993

Award-winning researchers

We are immensely proud of our researchers and pleased that the excellence of their research is recognised every year in a multitude of awards. The National Science and Technology Forum (NSTF) Awards, in partnership with South 32, the Women in Science Awards (WISA) and the National Research Foundation (NRF) Awards are just some of these. In the last year we have also celebrated the selection of three UCT researchers among the 15 Next Einstein Forum Fellows and five new A ratings.



Professor Crick Lund, director of the Alan J Flisher Centre for Public Health

TW Kambule-NSTF Award for research and its outputs over a period of up to 15 years

Lund's research has pioneered the development of mental health policies and services to address the growing burden of mental illness in South Africa and other low and middle-income countries (LMIC). [Read more](#)



Professor Sue Harrison, director of the Centre for Bioprocess Engineering Research and DST/ NRF South African Research Chair in Bioprocess Engineering

NSTF Award for engineering capacity development over the last five to 10 years

Harrison's research builds a holistic understanding of the biology, engineering and bioprocesses, essential to a sustainable bioeconomy, based on maximising renewable materials and resource productivity while minimising waste burden, including wastewater burden. [Read more](#)



Professor Peter Dunsby, professor of cosmology and co-director: Astrophysics, Cosmology and Gravity Centre, Department of Mathematics and Applied Mathematics

NSTF Award for research capacity development over the last five to 10 years

Dunsby's strategy for developing human capital has over the past 12 years focused on a pioneering initiative to develop the next generation of astronomers and space scientists – The National Astrophysics and Space Science Programme. [Read more](#)



Dr Tolullah Oni, senior lecturer at the School of Public Health and Family Medicine

TW Kambule-NSTF Award for emerging researchers

Next Einstein Forum Fellow

Oni's research aims to contribute significantly to knowledge on the changing patterns of disease and the implications this has for the health and well-being of the population in the context of urbanisation. Her Einstein Challenge is to establish the Research Initiative for Cities Health and Equity (RICHE), an interdisciplinary research programme for urban health research in Africa. [Read more](#)



Dr Sudesh Sivarasu, senior lecturer, Department of Biomedical Engineering

TW Kambule-NSTF Award for emerging researchers

Sivarasu has filed four patent family applications and has three granted patents for medical devices and several MedTech awards for his innovative medical devices. [Read more](#)



Professor Alison Lewis, dean of the Faculty of Engineering and the Built Environment

WISA Distinguished Woman Scientist for research and innovation

Lewis's longstanding interest in water and water treatment in an increasingly water-scarce South Africa led to her research into the treatment of acid mine drainage. This resulted in a process called eutectic freeze crystallisation, which converts contaminated mine water into clean potable water. [Read more](#)



**Dr Mohlopheni Jackson Marakalala,
Division of Immunology**

Next Einstein Forum Fellow

Marakalala's Einstein Challenge is to discover new therapeutic and diagnostic tools to combat infectious diseases mostly prevalent in sub-Saharan Africa. He hopes to contribute towards public dialogues that will help inform better health policies. [Read more](#)



**Dr Amanda Weltman, Department of
Mathematics and Applied Mathematics**

Next Einstein Forum Fellow

Weltman's Einstein Challenge is to develop a fundamental theory to explain dark energy and the cosmological constant, Einstein's so-called fudge factor, which appears to be causing the accelerated expansion of our universe. [Read more](#)



**Professor Xolela Mangcu, professor in
the Department of Sociology**

Harry Oppenheimer Fellowship Award

Mangcu is an Oppenheimer Fellow at the Hutchins Centre for African and African American Research at Harvard University and the author and co-author of nine books, and more than two dozen journal articles and book chapters. He will use the grant to complete *Nelson Mandela: romantic hero, tragic figure*, a biography on the late freedom fighter and politician. [Read more](#)



**Professor Michael Feast, emeritus
professor in the Department of
Astronomy**

NRF Lifetime Achievement Award

Feast is quite possibly the only academic to have published papers in *Nature* 66 years apart: the first in 1948, when he was just 21, and most recently last year at the age of 87. He is listed in the international *Who's Who*, he has had a minor planet named after him (Asteroid no. 10985 Feast, discovered from Mt Palomar in October 1977) and has represented South African astronomy at the highest international level. [Read more](#)



**Dr Ntobeko Ntusi, lecturer in the
Division of Cardiology, Department of
Medicine**

**NRF Research Excellence Award for
early career/emerging researchers**

Ntusi is completing his clinical training in cardiology and establishing an independent research programme on the study of cardiomyopathies and myocarditis. He has been appointed as head of the Department of Medicine from November 2016. [Read more](#)



**Professor Anusuya Chinsamy-Turan,
head of the Department of Biology**

New NRF A rating

Chinsamy Turan was the first person to deduce growth curves for dinosaurs, examining the microstructure of their fossilized bones. [Read more](#)



**Professor Bruce Hewitson, head of the
Climate Systems Analysis Group (CSAG)
and DST/NRF SARCHI Chair in Climate
Change**

New NRF A rating

Hewitson's core discipline is regional climate (change), but his research interests include modelling, downscaling and interesting analysis methodologies. He is also engaged in international activities, such as the International Panel on Climate Change and the World Climate Research Programme.

[Read more](#)



**Professor Bongani M Mayosi,
dean of the Faculty
of Health Sciences**

New NRF A rating

Mayosi's research interests include genetics of cardiovascular traits, treatment of TB pericarditis and prevention of rheumatic fever. In 2009, he received South Africa's highest honour, the Order of Mapungubwe in Silver, for excellent contributions to medical science. [Read more](#)



**Professor Chris Reason,
Department of Oceanography**

New NRF A rating

Reason is involved with research relating to southern hemisphere climate variability, southern African rainfall variability, mesoscale and coastal meteorology, tropical meteorology and oceanography, severe weather, ocean-atmosphere interactions, Indian and South Atlantic Oceans, Southern Ocean and ocean and atmospheric modelling. [Read more](#)



**Professor Gerald Nurick,
director of the Blast Impact and
Survivability Research Unit**

New NRF A rating

Nurick has been working in the field of impact dynamics for over 20 years. During this period, he has supervised more than 35 MSc and PhD graduates, who are now spread around the world, and has in excess of 100 academic publications.

Sustainable postgraduate development

The sustainable development goals (SDGs) adopted by United Nations (UN) member states in 2015 are wide-ranging, yet also specifically focused. Peter Meissner argues that postgraduate studies at UCT exhibit a similar picture, demonstrating wide-ranging, sought-after advanced education on the one hand, and specifically focused research, innovation and professional training on the other.

Many of the wide range of research topics and successes presented throughout this report speak to the SDGs, either directly or indirectly – or in some cases, even serendipitously. Research forms a – if not *the* – major fibre of postgraduate training and experience. The very fact that by far the majority (though no-one has formally analysed this yet, to my knowledge) of UCT research outputs involve the considerable work of postgraduate students implies, by corollary, that our students are having and will continue to have an impact on stated development goals.

Postgraduate programmes at UCT are numerous and diverse in focus – and growing. In 2015, some 35% of enrolled students across all faculties at UCT were postgraduate (9 733 of 27 809). This proportion has increased steadily over the years (from 31% in 2012), and the current research strategy aims for a target of 40% by 2025. The development of various blended, distance and further pure-contact postgraduate programmes at UCT, together with careful balancing of numbers of students undertaking full research and coursework-intensive degrees, will play a role in ensuring growth. We do not yet know how the imperative to transform and increase access and success across the postgraduate sector – while steering a path through the winds of austerity, curriculum realignment and funding – will affect these statistics.

It is also apparent that the rate of increase (other than in postgraduate diploma programmes) is slowing year-on-year (e.g. PhD enrolments increased by 16% from 2012 to 2013, by 12% from 2013 to 2014, and by

9% from 2014 to 2015). Just as limitations in research funding and physical resources play a role in limiting growth, so too do human resources – in particular, academic postgraduate supervision capacity and style. Throughout 2015, a variety of UCT players worked to ensure that supervision training, research and mentoring is increasingly considered and available.

Over the long term, the postgraduate student demographic has changed significantly, but there has been little change over the immediate term. The demographic picture of postgraduate students as a total UCT cohort in 2015 is very similar to that of 2014. Many South African voices consistently highlight concern for the lack of black South Africans entering and succeeding in the postgraduate enterprise (in 2015, 15.2% of registered postgraduate students were black South African). UCT has heard this call, and is working hard at recruitment (especially from within the undergraduate cohort) and support levels to change this demographic.

UCT postgraduate students perform well compared to the national average, and this performance is improving. By 2015, 35% of the 2012 cohort of master's students at UCT (i.e. four years after first registration after the first registration for the qualification) had either dropped out (20%) or were yet to complete (15%); the remaining 65% had graduated. Of all master's students graduating in 2015, the average time to graduation was 2.3 years. These figures are variable among different degrees, but are better than the estimated national averages (53% of the 2009 national master's cohort had either dropped out or were incomplete within five years of first

registering). Nevertheless, further analysis is needed of – and solutions must be found for – the relatively high attrition rate among master’s students, especially within the transformation context.

This is also true for our doctoral students. By 2015, of the 2010 cohort (i.e. six years after enrolment), 31% had dropped out, 44% had graduated, and 25% were still busy. The average time to graduation of all those graduating in 2015 was 5.2 years. Nationally, 61% of all doctoral students had dropped out or were yet to complete within seven years. International averages show similar drop-out rates, but time to completion is three to five years. I expect that in time, the various support programmes and policy initiatives that have been instituted over the last few years will gain traction, and further improvement in throughput rates at UCT will be noticeable.

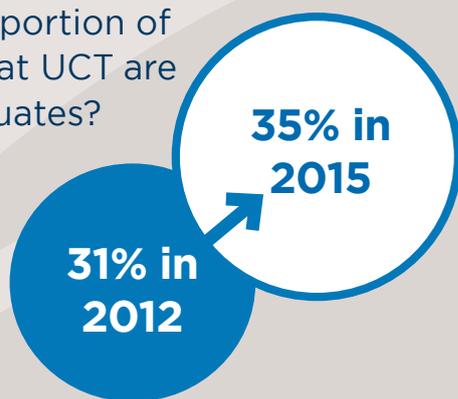
Postgraduate student funding is a complex issue. Many factors play a role in the awarding of funding. Thus, while it is impressive that in 2015, UCT was able to award R236.7 million to 2 975 honours, master’s and doctoral students, this represents some 38% of that student body, which is a marginally smaller proportion than the 41.7% awarded funding in 2014. On the upside, the amount of funding each student received was 18% higher on average (approximately R67 000 in 2014, and R79 500 in 2015). It is clear that to address the strategic and real demands to produce more quality postgraduates, and additionally to ensure an excellent group of ‘next-generation researcher-academics’, a significantly larger amount of funding is needed.

In order for UCT to continue as a national and an African leader, further on-the-ground work and planning must be instituted and grown to address the four national policy imperatives of postgraduate growth, transformation, throughput and quality. There are apparent contradictions between these four. Dealing with them must form the basis of ongoing strategising around postgraduate studies, and must also take cognisance of our growing research experience and strategy to ‘internationalise’.

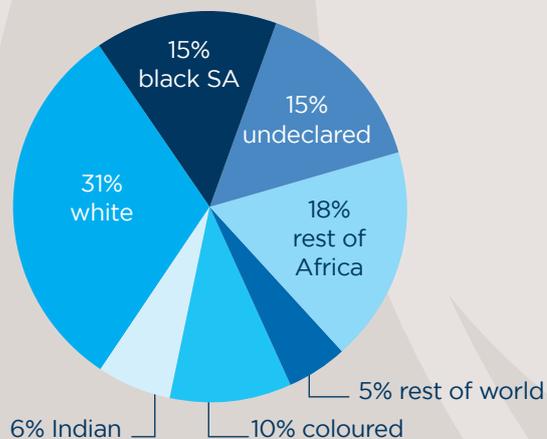
Overall, it is critical that UCT continue to research, encourage, train, communicate, strategise and develop further initiatives towards the support and development of the postgraduate student body, as well as of the programmes themselves. Academic, administrative and support staff must be informed, trained, and in step with this development. Strides and progress have been made – there are some spectacular stories, both in terms of student success and of impactful research – but our 2015 experience reinforces the need to build deeper within the postgraduate arena, sensibly and sensitively – and critically – within the context of the current South African and relevant global discourses. ○

Professor Peter Meissner is director of postgraduate studies.

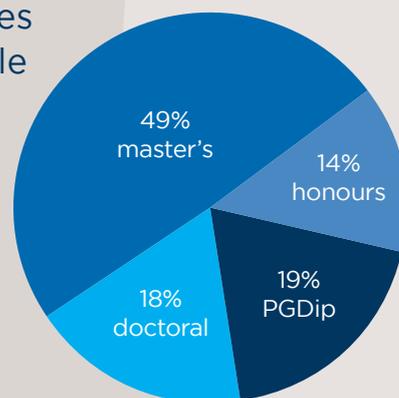
What proportion of students at UCT are postgraduates?



Demographic break-down of postgraduates in 2015



Postgraduates degree profile at UCT in 2015



38%

Postgraduates received funding and awards in 2015

Postgraduate perspectives

Lovemore Kunorozva

Department of Molecular and Cell Biology

PER3 VNTR Genotype Association with Chronotype, Performance, Illness, Injury and Re-entrainment

Kunorozva's PhD research investigates whether the PERIOD3 (PER3) genotype of South African Super Rugby players affected their performance or likelihood of injury and illness when they travelled across time zones. Crossing time zones is known to alter our internal body clocks, or circadian rhythms, which are important for regulating our sleep, daily functions and immune system. Rapid travel across time zones, which disrupts circadian rhythms, can alter sports performance and influence the likelihood of injury, as well as our immune system function. PER3 plays a role in circadian rhythms and sleep, and natural variations in this gene have been linked to being a 'morning type' or an 'evening type' of person. Kunorozva also found that the PER3 genotype contributed to the re-setting of the internal clock required after time-zone travel. [Read profile story](#)



Sizakele Sizo Sibanda

Department of Biological Sciences

Deriving Benefits from Marine Protected Areas

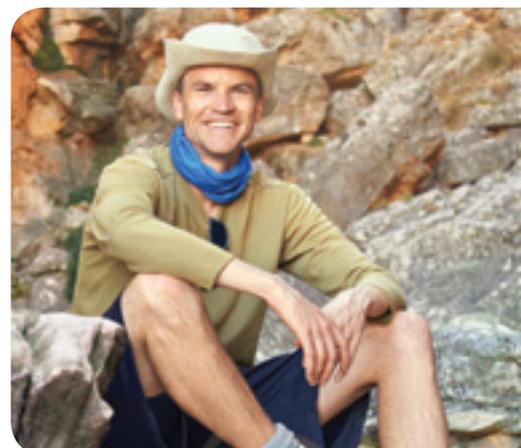
South Africa has 0.4% of its mainland ocean territory designated as marine protected areas (MPAs). Given that 98% of ocean space in South Africa is under petroleum and mining lease, and the trawl fishery industry is yet to implement effective seabed management, marine protection remains a pressing issue. Sibanda's master's research looks at the level of ecosystem protection within the proposed MPA network, and the benefits that can be derived from conservation goals and socioeconomic needs. In 2014, Operation Phakisa – a presidential initiative – was launched to accelerate development in the marine sector. This provided a platform for stakeholders to collaborate and highlight areas of interest. A commitment was made to increase protection to 10% by 2019, which prompted research to identify the areas that are most representative of our marine environment, as well as how challenges faced by the current MPA network can be addressed.

Matthew Lewis

Department of Biological Sciences

Ecology of Marine-Foraging Chacma Baboons

The chacma baboons of the Cape Peninsula are well-known for their tendency to raid vehicles, residences and farms. However, there are still baboons on the peninsula that do not engage in such behaviour, but supplement their diets with animal-derived foods from the marine intertidal zone. This behaviour is unusual in baboons, and remains poorly understood from an ecological point of view. For his doctoral thesis, Lewis investigated the exploitation of marine foods in the last remaining natural-foraging troop of chacma baboons on the peninsula. He showed that marine foods comprise only a small proportion of this troop's diet. Behavioural indicators suggest that eating such small amounts of marine food has not alleviated the stress associated with living predominantly in nutrient-poor fynbos habitats. [Read profile story](#)



Ngwako Radodiba Adam Mohale

Department of Oceanography

Investigating the Effects of Agulhas Leakage on the South Atlantic

"I've always been passionate about nature; and growing up in an environment where farming was the order of the day for subsistence, and witnessing the changes in seasonal patterns, all grew my interest in understanding what drives the climate," says Mohale. Agulhas leakage acts as a primary ocean current that connects the Indian and Atlantic Ocean. It plays a vital role in global water circulation, which has an important role in influencing global climate, so it is important to understand the dynamics of Agulhas leakage and its role in global ocean circulation. Because of different dynamics between the Indian and the Atlantic Oceans, Mohale's master's research aims to report how Agulhas leakage affects the South Atlantic, and how the South Atlantic ecosystem could be affected by such changes. "The South Atlantic Ocean has long been suspected to have an effect on South African weather patterns, so it'll be interesting to further understand the intensity of this effect," he says.



Philile Mbatha

Department of Environmental and Geographical Science

The Influence of Plural Governance Systems on Rural Livelihood Strategies in South Africa: the case of Kosi Bay

In South Africa, the livelihoods of a significant number of rural households living along the coast rely on harvesting marine resources, timber, non-timber forest products, and agricultural resources for subsistence or small-scale sale. Simultaneously, biodiversity protection in the form of internationally and nationally recognised protected areas is increasingly being enacted in South Africa. These areas are usually adjacent to rural communities that were historically marginalised during apartheid and continue to be so today. Coastal authority in rural areas of South Africa remains highly contested by multiple systems of governance. This is exacerbated by the fact that institutions with mandates over coastal governance in rural areas usually also operate in silos, creating red tape that slows down development opportunities. Through the lens of Kosi Bay, a rural area located within South Africa's first World Heritage Site, iSimangaliso, Mbatha's doctoral research documents livelihood strategies and interrogates how people's livelihoods are influenced by the existence of multiple and plural coastal governance systems and processes. [Read profile story](#)

Tamzon Talisa Jacobs

Centre for Minerals Research, Department of Chemical Engineering

Process Mineralogical Characterisation of Kansanshi Copper Ores in North-West Zambia

The mining industry currently faces numerous multifaceted challenges, one of which is the difficulty of efficiently extracting valuable minerals needed to meet the demands of modern society. Jacobs' master's research focused on understanding the process mineralogy of ore from Africa's largest copper producer. This is a critical step for enabling engineers to separate and upgrade the valuable minerals from the waste efficiently, and ultimately produce a saleable metal. Jacobs used modern mineralogical analysis tools and laboratory experiments that helped her understand how various ore-formation events produced the array of minerals and textures present in this complex copper ore. When applied to ores fed to the three different processing circuits at Kansanshi, this knowledge can be used to improve performance and reduce operational costs. Jacobs is now working in Zambia at a neighbouring copper mine, putting her skills to the test. [Read profile story](#)

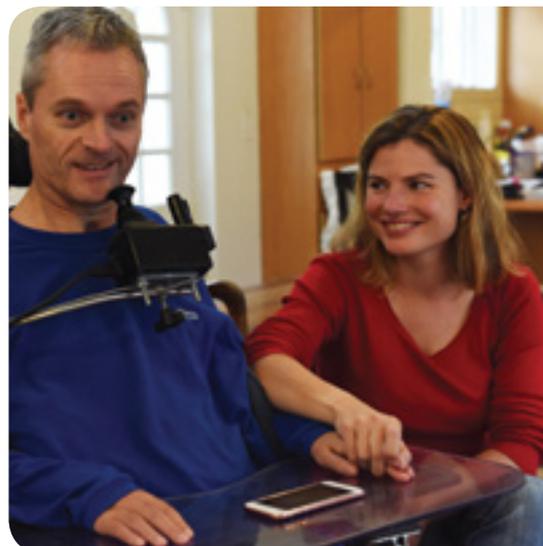


Victor John McKinney

Department of Health and Rehabilitation Sciences

Are Civil Engineer Undergraduates Learning how to Accommodate People with Disabilities in the Built Environment?

Disabled people represent 15% of the population and encounter many daily challenges within the built environment, despite legislation calling for accessible buildings and transport systems. As civil engineers are at the heart of all infrastructure, McKinney's doctoral research set out to explore whether undergraduate civil engineering students at UCT are being prepared to contribute to an inclusive society that accommodates people with disabilities. His findings revealed a conspicuous gap in collaboration between the stakeholders, which hinders the adoption of a multidisciplinary approach in the preparation of students. Despite strong commitment to transformation by the Engineering Council of South Africa and UCT, he found that more could be done to incorporate disability and the concept of universal design into engineering education and practice. [Read profile story](#)



Disa Mogashana

Chemical Engineering, Engineering Education Research Group

How Academic Development Programme Students Make Their Way Through Their Studies

Mogashana's PhD investigates how students who were part of an Academic Development Programme (ADP) negotiated their way through to the fourth year of their studies – against the odds. She interviewed 12 engineering students; her findings show that students in difficult circumstances have to be innovative in navigating academic obstacles such as a fragmented curriculum, shortened examination periods, and unfavourable examination timetables. She also found that having been in an ADP had 'unintended consequences' that left the students with feelings of marginalisation and exception. Moreover, because of historical circumstances, many of the students in the Academic Support Programme for Engineering in Cape Town (ASPECT) are black, and felt there was an element of racial exclusion related to the ADP. The study highlighted that, while the ADP has facilitated entry to the university for students, it also exacerbates their experience of exception. [Read profile story](#)

Corey Beavon

Minerals to Metals Signature Theme

Sustainable Mineral Development

Master's student Beavon is specialising in sustainable mineral development, and is working on projects that include how to operationalise the sustainable development goals (SDGs) in the South African mining industry, and investigating the barriers to and opportunities for growth in the industrial-mineral industry. He has been accepted for an internship at the World Economic Forum (WEF), and is working on ensuring the SDGs are integrated into the Responsible Mining Development Initiative (RMDI), a flagship project at WEF. The RMDI is a multi-stakeholder tool that provides practical mechanisms to measure and communicate the needs and expectations of stakeholders in the mining industry, and is currently being tested in Guinea.



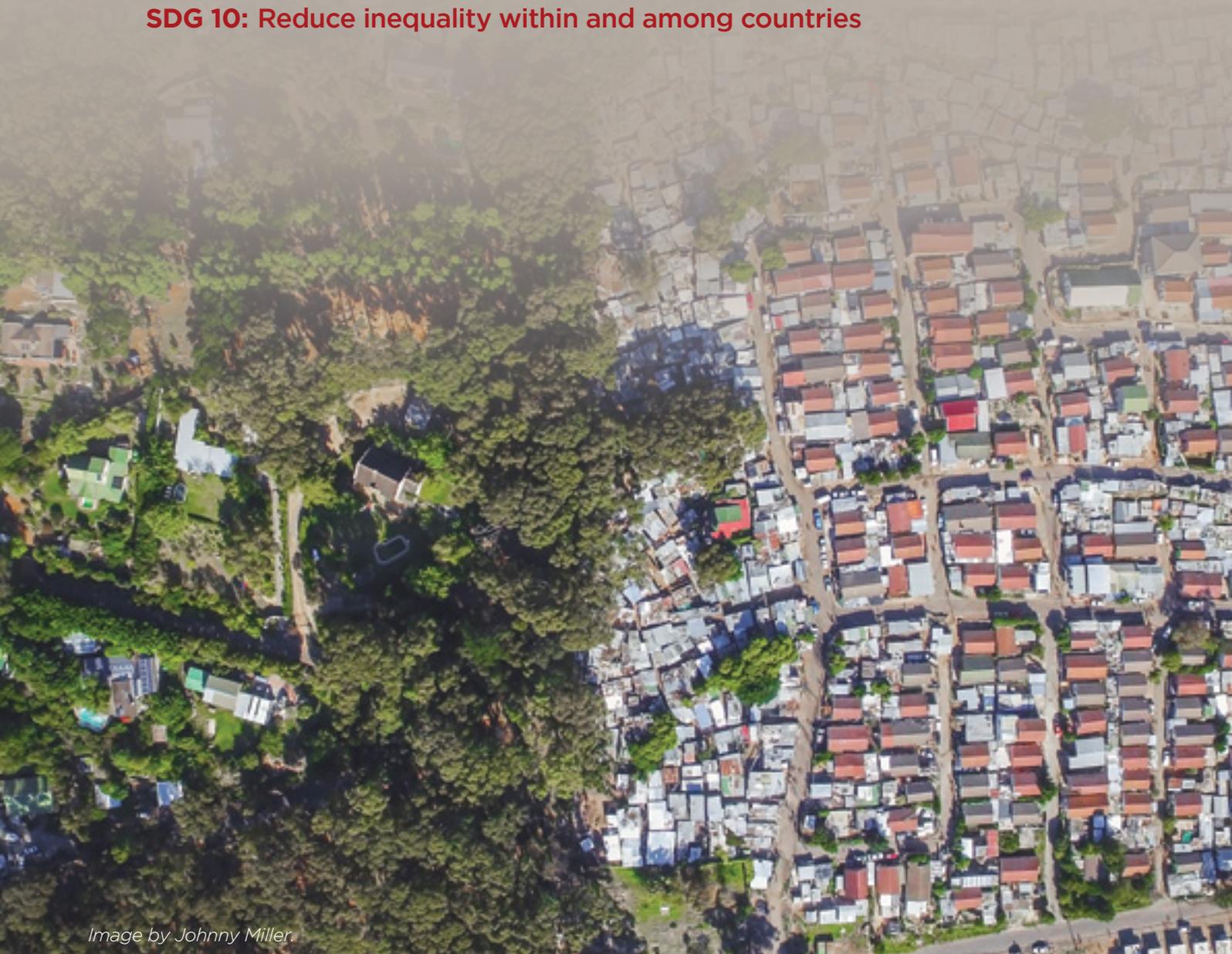


No poverty, economic growth and reduced inequalities

SDG 1: End poverty in all its forms everywhere

SDG 8: Promote inclusive and sustainable economic growth, employment and decent work for all

SDG 10: Reduce inequality within and among countries



Researching pivotal economic challenges facing South Africa



Researching two of the key challenges of our time – poverty and inequality – is at the heart of the work carried out by UCT economics Professor Haroon Borhat, who holds the DST/NRF SARCHI Chair in Economic Growth, Poverty and Inequality: Exploring the Interactions for South Africa.

Currently the most cited economist in South Africa, Borhat is committed to adding to the base of knowledge in a dynamic way, through his own research and relationships with research partners in South Africa, Africa and globally.

“We want to ensure that our work within the ambit of the SARCHI initiative becomes globally renowned, and is at the cutting edge of current academic thinking,” he says.

Borhat, who is also the director of the Development Policy Research Unit, is widening his research in Africa, from inequality on the continent to Africa’s manufacturing malaise, as well as looking at resource dependence and inclusive growth.

In one such example, he is studying six African economies in research on growth, inequality and poverty under the SARCHI initiative.

Drafting the SDGs

Borhat’s focus on Africa also flows from his work for the United Nations Development Programme (UNDP) on the sustainable development goals (SDGs). He was selected to lead a team that conducted research to underpin the thinking of the 17 SDGs announced last October. The high-level panel included the heads of state of Liberia, the United Kingdom and Indonesia.

“With the theme of ‘Leaving no-one behind’, we needed to move from the framework set by the millennium development goals towards taking into account a whole range of new considerations on the environment, sustainability and gender,” says Borhat.

“The SDGs need to ensure that all sub-groups – be they at country level, or disadvantaged or marginalised groups within a country – experience the same kind of progress. The goals around equality are really about having a more equal growth path for all marginalised groups in a society.”

Borhat considers the opportunity to be part of the historic drafting of the SDGs to be a career highlight.

“It was an incredible experience, and very humbling to recognise that the core skills sets you have can be used on a global scale.

“What’s important is that it allowed us to elevate our thinking as South African economists to where the global discussions are, and to where they have resonance at a global level.”

Borhat – who has a PhD in economics from Stellenbosch University, studied at the Massachusetts Institute of Technology, and was a Cornell University research fellow – says the research for the UNDP in New York helped to provide a road map for the goals.

“The challenge now is to ground all of the goals and lofty ambitions, and mould the SDGs into a

specific plan of action. Every country needs to think about how to implement them so that they can show progress.”

Bhorat and his team continue to provide back-up research and a knowledge base.

His work for the UNDP has helped him to shape a research agenda on a series of economic-policy questions, related to the SDGs, but focused on sub-Saharan Africa.

Shaping Africa’s research agenda

He has also initiated an active research agenda on sub-Saharan Africa, grounded in empirical labour economics, but applied to low-income countries in Africa.

“It’s virgin territory globally, and hopefully we are placing ourselves as a UCT collective at the forefront of a unique and innovative global programme.”

The SARChI has been strengthened within the context of the Africa Growth Initiative at the Brookings Institute, where Bhorat is a non-resident senior fellow.

Under the poverty, inequality and growth banner, researchers are exploring regional drivers of growth in west, east and southern Africa.

“We need to think about disruptive growth strategies ... about changing the way we do business, to redirect state subsidies from traditional industries, in some cases, and to new industries. We need to put employment at the centre of industrial and trade policy,” says Bhorat.

One of the key questions researchers are asking is how to protect employment in a job-starved economy. “The growth and development path in Africa doesn’t have manufacturing at its centre. We need to build capabilities and links with other institutions to see how we can change this.”

South Africa’s labour market

In South Africa, Bhorat’s name has become synonymous with labour-market research, particularly his investigation into a national minimum wage for South Africa. Together with a very dedicated team of researchers, he has explored the impact of minimum-wage laws on employment, wages and hours of work, and has advised and consulted on sectoral minimum-wage rates.

In South Africa, the most unequal emerging economy in the world, these kinds of questions are critical.

The huge inequality in education in South Africa and the unequal structure of the economy has been driven by South Africa’s fractious apartheid past.

“Unless you change the structure of the growth path, the schooling system and where people live, you will always have this replication of an unequal growth path.

“With very large firms dominating industries in South Africa, smaller enterprises and the informal sector find it very difficult to break into those markets. Much of the economic output is under the tutelage of very few firms. The ownership structure requires change, but in a way that retains incentives for companies.”

As a SARChI chair, Bhorat’s approach is to combine vigorous, academically credible research with policy-relevant questions and issues, from the national minimum-wage debate to student financial aid.

Looking ahead, he says certain issues deserve more careful analytical work. These include the debate around the national minimum wage, the rise of labour brokers, employment generation in the economy, and the future of Skills Education Training Authorities (SETAs). The unit will continue to be central in providing analytically rigorous information to relevant government departments and ministers.

Bhorat’s work has earned the recognition and praise of his peers.

“In my opinion, Haroon is South Africa’s pre-eminent economist working at the interface of research and policy,” says Professor Murray Leibbrandt, SARChI Chair in Poverty and Inequality.

“He is listened to and enjoys the trust of government officials at the highest level and across a number of ministries. This trust is forged on the basis of the measured, reliable research that he always brings into the policy processes in which he is involved.”

Hope for the future

Bhorat holds a number of key positions in global policy organisations, including recently being appointed a member of the World Bank’s Commission on Global Poverty. While his work schedule is demanding, he thrives on what he does.

“I’m very passionate about the work I do. I’ve always loved the idea of interrogating something further intellectually, but hopefully with an eye on a policy question, or a societal problem.” And on home turf, despite a somewhat bleak economic outlook, he has great hope for the country.

“I’m very optimistic. I’m South African through and through, and we remain optimists.” 

By Kim Cloete. Image supplied by Southern Africa Labour and Development Initiative.



South Africa: who gets what – and why

Poverty in contemporary South Africa is both extensive and modest at the same time. It is extensive in that the ‘poverty headcount’ – the proportion of the population living in poverty – is higher than in other middle-income countries with similar levels of gross domestic product (GDP) per capita. At the same time, the ‘poverty gap’ – the difference between the incomes of the poor and the poverty line – is small in relation to the total income in society.

This means that the redistribution of a small amount from the rich to the poor could eliminate poverty. Indeed, the poverty gap is small by comparison with the increase in GDP per capita since the end of apartheid: the additional resources available through economic growth could have been used to eliminate poverty without any reduction in the standard of living of the non-poor.

In a democracy, one might expect that political pressure from the large number of poor and almost-poor people would ensure that the benefits of economic growth would be directed towards the relief of poverty, whether directly or indirectly.

The available data suggest that poverty did decline in the 2000s, primarily because of the expansion of cash transfer programmes such as the Child Support Grant. Public-housing programmes and the massive rollout of antiretroviral drugs also resulted in an improved quality of life that is not reflected in the data on income poverty. But widespread poverty has persisted. Most

of the gains of economic growth have accrued to the non-poor, and redistribution to the poor has not come close to eliminating poverty.

Role of policy in reproducing poverty

In our new book, *Policy, Politics and Poverty in South Africa* (published in the UK in 2015, and to be published in South Africa by Jacana in 2016), we examine how and why poverty has persisted, focusing on the ways in which public policies serve to reproduce as well as mitigate poverty. The book comprises three sets of chapters. The first set considers who have been the ‘winners’ and who the ‘losers’ as a result of economic growth and change since the end of apartheid. We show that the ranks of winners include not only the rich, or upper and middle classes, but most households with members in formal employment. In real terms (i.e. taking inflation into account), wages for almost all of the formally employed have probably risen: albeit, often,

along with debt – the rising standard of living has been financed through both rising income and rising debt. At the same time, a large class of poor people – confined to the very edges of the labour market – has experienced only modest benefits, if any.

Neoliberalism overstated

This pattern of winners and losers is rooted in public policy. Most critics of post-apartheid public policy emphasise the influence of neoliberalism, to which they attribute these high levels of inequality. For two reasons, we argue that this is \only part of the story. First, explanations focusing on neoliberalism exaggerate the extent to which the government's social policies and service delivery have been characterised by 'recommodification' (a reversion to market-based distribution), and underestimate the extent of 'decommodification' (the recognition that citizens have claims on society independently of their position in the labour market). One in three South Africans receives a government grant or pension, millions live in publicly funded housing and benefit from subsidised municipal services, and millions more are alive because of publicly funded antiretroviral treatment.

The challenge of an over-regulated labour market

Secondly, the state is heavily involved in the regulation of wages in the labour market, especially through minimum-wage-setting for less-skilled workers. We argue that this is a major contributory factor in the persistence of unemployment, and hence poverty, because – in combination with industrial and other public policies – it serves to steer the economy down a growth path that favours people with capital and skills, and disadvantages those with neither. Poverty persists in South Africa, not primarily because of insufficient economic growth or the absence of redistribution, but because the economic growth path has not resulted in job creation; and the ensuing poverty has been too large to eliminate easily through redistributive government expenditure.

Lastly, we turn to the politics of distribution and redistribution. The formal architecture of representative democracy only partly empowers the poor, because – as is now well-recognised – the electoral system contributes to the centralisation of power within political parties, and the erosion of accountability to voters. The judiciary, and especially the Constitutional Court, provides modest pressure on the government to realise social and economic rights, but it is compelled to act cautiously in the face of legislative and executive conservatism. Business is less powerful than often alleged, with the governing party remaining deeply ambivalent



about established, 'white' business. Organised labour, however, has enjoyed considerable political power, securing broadly labour-friendly policies across a range of government departments – and contributing to an economic growth path that favours higher wages over job creation.

Finally, direct action by the poor – the so-called 'rebellion of the poor' in urban areas across the country – has proved effective as a way of registering discontent with service delivery, primarily by local government, but does not address the underlying causes of enduring poverty in the form of an economic growth path that results in massive unemployment. ○

By Professors Jeremy Seekings and Nicoli Nattrass of the Centre for Social Science Research. Images by Matthew Skade.



Why South Africa isn't cashing in on its demographic dividend

South Africa has very high unemployment levels. Part of the reason for this is that there has been a disconnect between the growth in employment and the growth in the labour force.

Although growth in employment has kept pace with growth in the working-age population, it has not kept pace with growth in the labour force. Unemployment has therefore increased, both in absolute terms and as a proportion of the labour force.

The disconnect between the growth in employment and labour force emphasises the importance of understanding the long-term challenges and opportunities associated with demographic change. A country achieves a demographic transition when it shifts from a high-fertility, high-mortality equilibrium to a low-fertility, low-mortality equilibrium.

It is then associated with two potential dividends that contribute to long-term economic growth and development. The first is triggered by falling fertility rates after a decline in mortality rates, particularly among children. The second can be realised through capital deepening. South Africa is in the midst of just such a demographic transition. The magnitude of South Africa's demographic dividend is in line with that of other middle-income countries. But estimates of the first demographic dividend show that we have passed through at least half the period in which it is expected to be positive; the magnitude of the dividend is now falling.

The two demographic dividends

One useful measure for analysing this transition is the support ratio. This compares the number of effective workers with the number of effective consumers. A rise in the support ratio means a lower level of dependence. Declining fertility leads to a reduction in the number of dependent children

compared with non-dependent adults. In addition to demographic change, both income and consumption at each age influence the rate of change of the support ratio, and the magnitude of the demographic dividend. In South Africa, income begins to rise at a later age, and is lower – relative to peak income – than among young people in other countries; Also, per-capita income falls significantly for older working-aged adults.

South Africa is at a relatively advanced point in the demographic transition. The youngest cohorts within the working-age population are expected to stabilise in size and begin to contract. At the same time, the number of older working-age people – who comprise a large proportion of effective consumers – is expected to grow rapidly. To benefit from the final phase of the demographic dividend, the economy needs to grow employment and improve labour-market prospects for younger working-age people. Greater employment will raise mean incomes, allowing South Africans to invest in education and save. These actions are crucial for achieving the second demographic dividend.

The evidence confirms that inequality in consumption is limiting the size of the demographic dividend. This suggests that weak sharing mechanisms in the country may have a negative impact on per-capita income growth over time. In some sense this provides support for the argument that inequality acts as a brake on economic growth.

Morné Oosthuizen is deputy director of the Development Policy Research Unit. Image by Heinz-Josef Lücking, Wikimedia Commons.

Ingrid Woolard has social justice at heart

“She is without peer as a producer of survey data, and a top-cited economic researcher,” says Professor Murray Leibbrandt, pro-vice-chancellor for poverty and inequality, of Professor Ingrid Woolard, dean of the Faculty of Commerce and professor in the School of Economics.

Woolard’s work has focused primarily on the use of data to better understand the nature of poverty, inequality and unemployment in South Africa. It was in recognition of this that she won UCT’s prestigious Alan Pifer Award in 2015. The Alan Pifer Award is the vice-chancellor’s annual prize for outstanding welfare-related research.

Woolard cut her teeth as a data manager on the country’s first national living standards measurement survey in 1994, which the Southern Africa Labour and Development Research Unit (SALDRU) produced with the World Bank, at the request of the African National Congress.

Woolard was also a key team member in the second and third waves of the KwaZulu-Natal Income Dynamics Study (KIDS). This used the KwaZulu-Natal component of the 1993 Project for Statistics on Living Standards and Development, and then re-interviewed this sample in 1998, and again in 2003. KIDS was South Africa’s first socioeconomic panel survey, and it pioneered the analysis of poverty and inequality dynamics in South Africa.

Based on this data, Woolard’s work showed how destitution has driven many urban-based unemployed people back into rural areas, to survive off the pensions of parents and grandparents. This work was influential in unpacking how South Africa’s unemployed actually survive. It was also an important revelation for policymakers, to understand how unemployed people are forced to move away from labour markets.

Given this experience, Woolard was the first choice as a principal investigator for SALDRU’s bid for the National Income Dynamics Study (NIDS), the country’s flagship national household panel survey, which was launched in 2008. Later, by making the survey data widely available, Woolard positioned it as South Africa’s highest-profile national survey, with the unique potential to reflect the country’s evolving socioeconomic dynamics.



Woolard’s contributions have been internationally recognised. She was the only South African labour economist invited to be a member of the labour market team within the Harvard Group that National Treasury tasked with preparing a South African growth strategy. In 2011, the minister of labour appointed her to chair the Employment Conditions Commission. The commission, which makes sectoral wage determinations for vulnerable workers who are not covered by formal wage bargaining procedures, was informed by her own work on labour markets and inequality. She gave up the position in 2014, after being appointed to the Davis Tax Committee.

In 2016, Woolard was appointed dean of the Faculty of Commerce, an important next step in her already fruitful career.

“There’s a lot of really excellent socially driven research going on in the faculty,” she says. “And as dean, I’m looking forward to shaping the direction that takes.” 

Adapted from an [article](#) by Helen Swingler. Image by Michael Hammond.

Unshackling Africa's economic growth

Unchecked, rising inequality is one of the most important risks to the sustainability of African growth. Africa is in much better shape than it was 30 years ago. Growth has risen, poverty has been reduced, violent conflicts are less prevalent, and democracy and other forms of accountability are found in many more countries. The risk, writes Alan Hirsch, is that these gains are not consolidated and Africa slips into the same kind of stagnation that afflicted it in the 1980s and early 1990s.

The current slowdown is quite a serious challenge to sustainable African growth. Compounded with drought, humanitarian and financial crises are likely. Added to this, very few African countries are trying to compete globally in growing markets with new exports.

Growth has not led to greater competitiveness. While there are some productivity gains, especially in agriculture and mining, Africa is largely not catching up with global competitiveness trends.

Finally, Africa's growth has not been equal. The income and wealth gaps between countries — as well as the gaps within many countries — are growing.

Inequality in Africa a grave concern

Southern Africa tends to have the most inequality within countries. South Africa (SA), Namibia and Botswana are among some of the most unequal countries in the world, and Angola and Zambia are not far off.

The average Gini coefficient for Africa is 0.43, which is significantly greater than the coefficient for the rest of the developing world at 0.39. On average, the top 20% of earners in Africa have an income that is more than 10 times that of the bottom 20%.

Gender inequality is a critical issue and it is not



improving significantly. There has been some progress in equalising access to education for girls and boys at primary school level, but there has been no progress, on average, in achieving gender parity in secondary schooling, and there has been a widening of gender inequality in tertiary education enrolment.

With many African countries relatively unequal, poverty reduction in Africa has not been nearly as rapid as it might have been, considering the rate of growth. In countries with high levels of inequality, even rapid economic growth often has a very small effect on reducing poverty.

Uncertainty a fear factor for investors

High levels of inequality are ultimately a constraint on growth, and also undermine social cohesion. Growth economist Johannes Fedderke argues in a 2010 policy paper, *Sustainable Growth in SA*, that the main reason for relatively low levels of private investment in the country is the high level of uncertainty.

Uncertainty, he says, reflects a perception of political instability and has a marked effect on private sector investment. So the lack of social cohesion, largely an outcome of inequality and other social cleavages, contributes to low rates of growth.

A comparative look at Africa

There is strong evidence that developmental and institutional reforms can reduce inequality. As in Latin America, once the most unequal continent, levels of inequality have decreased in many countries.

Broadening the distribution of education can have a positive effect by raising productivity and reducing the difference in income. In SA and in many other African countries, the skills differential remains extremely high.

Social assistance has counteracted inequality in SA, Ethiopia and several Latin American countries – the evidence is already very clear.

In many African countries, tax collection is lower than it should be and a general improvement in taxation systems could have a significant effect on the ability of a country to address inequality.

The tax collection rate in Latin America increased by 3.5% of GDP in the 2000s – a huge step forward and one that has not since been reversed. This was in addition to an increased commitment to education and social assistance in recent decades.

Latin American countries reduced their external vulnerability to shocks by avoiding the accumulation of foreign debt or large deficits, by adopting flexible exchange rates and by accumulating large foreign reserves. All this

reduced the effect of shocks, which damage the livelihoods of the poor much more than those of the rich.

Land redistribution, accompanied by measures to encourage agricultural productivity, was an important foundation for relatively equitable growth in Asian countries such as Japan, South Korea and Taiwan.

Policies, institutions and leadership key to growth

Policies to develop high-growth sectors – such as manufacturing, construction and labour-intensive services – could have a significant effect on decent employment.

Finally, strong institutions are critical to underpin reforms that support growth and redistribution. This might sound obvious today, but it was not obvious to the global policy-makers of the 1980s and 1990s.

Africa needs smart, bold, well-informed leaders who understand what works and what is implementable. 

Professor Alan Hirsch is director of the Graduate School of Development Policy and Practice. Main image by Deutsche Gesellschaft für Internationale Zusammenarbeit, Violence and Crime Prevention. Image of Lagos by Stefan Magdalinski, Wikimedia Commons.





A minimum wage needs to balance risk and opportunity, says DPRU

The benefits of setting a national minimum wage at R2 447 per month could, on average, outweigh the costs, but setting it at R3 400 could risk far greater job losses, warns a research paper from the Development Policy Research Unit (DPRU). Agriculture stands to lose a much bigger proportion of jobs than a sector such as mining, as farmers might struggle to afford a new minimum wage.

Weighing up the costs and risks of setting a national minimum wage at these two levels, the DPRU, in a study led by Professor Haroon Borhat, argues that a baseline of R2 447 could result in job losses of up to 281 000 people across the board. This is far more palatable than the more than 500 000 low-wage workers who might expect to lose their jobs should the baseline be set at R3 400.

But when it comes to the bigger picture of socioeconomic equity, a national minimum wage would only be one – and perhaps a minor – component of a broader social programme to reduce inequality, boost employment and grow the economy.

How they got to those numbers

Bhorat and his fellow researchers attempted to provide a three-part analysis. The first part was an international review of the experience of minimum wages in mainly developing countries. They explored the types of minimum wages used around the world – whether they were sectoral or national – including the reach, and the type of enforcement used. They also looked at the impact of minimum wages on employment in particular.

The second part of the study was an examination of existing research on minimum wages in South Africa, “because, of course, we do have an existing system

of minimum wages,” says Borhat. “These were set either by sector (such as in agriculture) or occupation (contract cleaners).”

The third part of the analysis was to explore a feasible range for a minimum wage.

Those two levels were firstly the median of the existing sectoral determinations, and then the median South African wage, set at R2 447 and R3 400, respectively. From this, the researchers asked how employment – and job losses – would be affected should minimum wages be implemented at either of those levels.

So, is it worth it?

In the R2 447 scenario, around 281 000 jobs could be lost, the paper concludes. In the R3 400 scenario, this number rises to 566 100 – that’s 4.3% of employees.

“There’s significant sectoral variance in the potential job losses, with many of the jobs lost in sectors such as business services, domestic work and agriculture,” explains Borhat.

“So the real question for me is: Can we find a creative way to set a national wage that recognises it is going to bite some low-wage sectors much more than others?”

Could the economy eventually reabsorb workers who lose their jobs?

In a perfect world, a higher minimum wage would mean higher productivity and potentially you could cope with an increase in labour costs, says Borhat.

“That’s an incredibly hard thing to measure. It’s an uncertain outcome. We’re almost forced into a very defensive position because we’ve got very high unemployment rates – so an excess supply of labour – and you’ve got a low-growth environment.

“Labour markets with low unemployment, economies that are growing fast and that are dynamically competitive; this is where those arguments come into play,” says Borhat. “The national minimum wage is used, if you like, as a mechanism for increasing productivity, for extracting creative value out of labour for the production of goods, which then can be exported and it builds on a particular growth

path. We’re not in that game, unfortunately.”

Socioeconomic parity needs more than a minimum wage

Brazil is often cited as a poster child for what a national minimum wage can do to boost productivity and increase employment, says Borhat.

The research shows, however, that a minimum wage played only a minor role in the Brazilian growth miracle, he says.

“Leave aside the fact that the growth miracle is now over. The massive poverty reductions and stalling of inequality that you saw in Brazil was primarily a function of two things: one is the conditional cash grant system, and the other improvements in the quality of the education system, which led to an increase in the supply of school graduates.”

That drove down the wage premium, and with more people competing for higher-skilled jobs, inequality went down, and the massively improved quality of the labour supply fuelled growth and created an aggregate demand kick for growing employment, says Borhat.

These strategies are workable in South Africa, then, if sectors like education come to the party.

“You can find situations where you want to improve the quality of the schooling system precisely so that it acts as a trigger for unlocking this cycle of inequality, because what you’re then doing is reducing the wage premium on skilled workers.”

And that’s the crux of the argument put forward by Borhat and his research team.

“For internal labour markets, obviously if you raise the national minimum wage, you’re going to reduce wage inequality in a workplace. But it’s not clear that for combatting society-wide inequality, it’s the best or most appropriate instrument in South Africa.

“One has to take a broader approach and locate the inequality and poverty cycle within all of these contexts.” 



Story by Yusuf Omar. Image by Solidarity Center, Flickr.



How can we grow employment in South Africa?

One of the greatest challenges in post-democratic South Africa is massive and growing unemployment. In a country with substantial resources and a government that claims to be serious about addressing the issue, this lack of progress is not only troubling, but puzzling.

The data remain controversial, but even the more optimistic projections show that large-scale unemployment will remain an issue, even under rapid-growth scenarios. According to one estimate, the South African economy would have to grow at an average rate of 7% for about 15 years in order to reach the average global employment rate.

In *Towards Employment-Intensive Growth in South Africa*, edited by Anthony Black, professor in the School of Economics, a common thread that joins the various chapters is what policies are needed to steer the economy onto a more employment-intensive growth path. There is not one single policy change that will achieve this, says Black. What is needed, rather, is a host of small and large interventions in all sectors of the economy, perhaps underpinned by an 'employment compact'.

Towards employment-intensive growth in South Africa by Anthony Black is published by UCT Press.

Economic impact of informal sector not to be underestimated

Building on existing research into consumer markets, the University of Cape Town's Unilever Institute of Strategic Marketing has uncovered hidden consumer markets in a study titled *Connecting with Survivors*. The research, which focused on those whose household income is less than R6 000 a month (referred to as 'survivors') attempts to understand the significant role the informal sector plays in growing the country's GDP. The study revealed a far higher rate of economic activity in this sector than has previously been recorded.

Since 1994, economic activity has gone up slightly among the poor, due to social grants; while the upper end of the market has experienced massive growth. The so-called

'missing middle' has previously been recorded as experiencing no growth. But the Unilever study found that people in this 'survivors' category do not present their full earnings to official government sources, for fear of losing their access to the grants. This unrecorded income draws a new picture of economic activity in the informal sector.

The research was conducted in Tembisa and Ivory Park, situated between Pretoria and Johannesburg, and found that there is on average one enterprise for every 10 households, and more than one million unregistered and 'mostly unrecorded' enterprises countrywide.

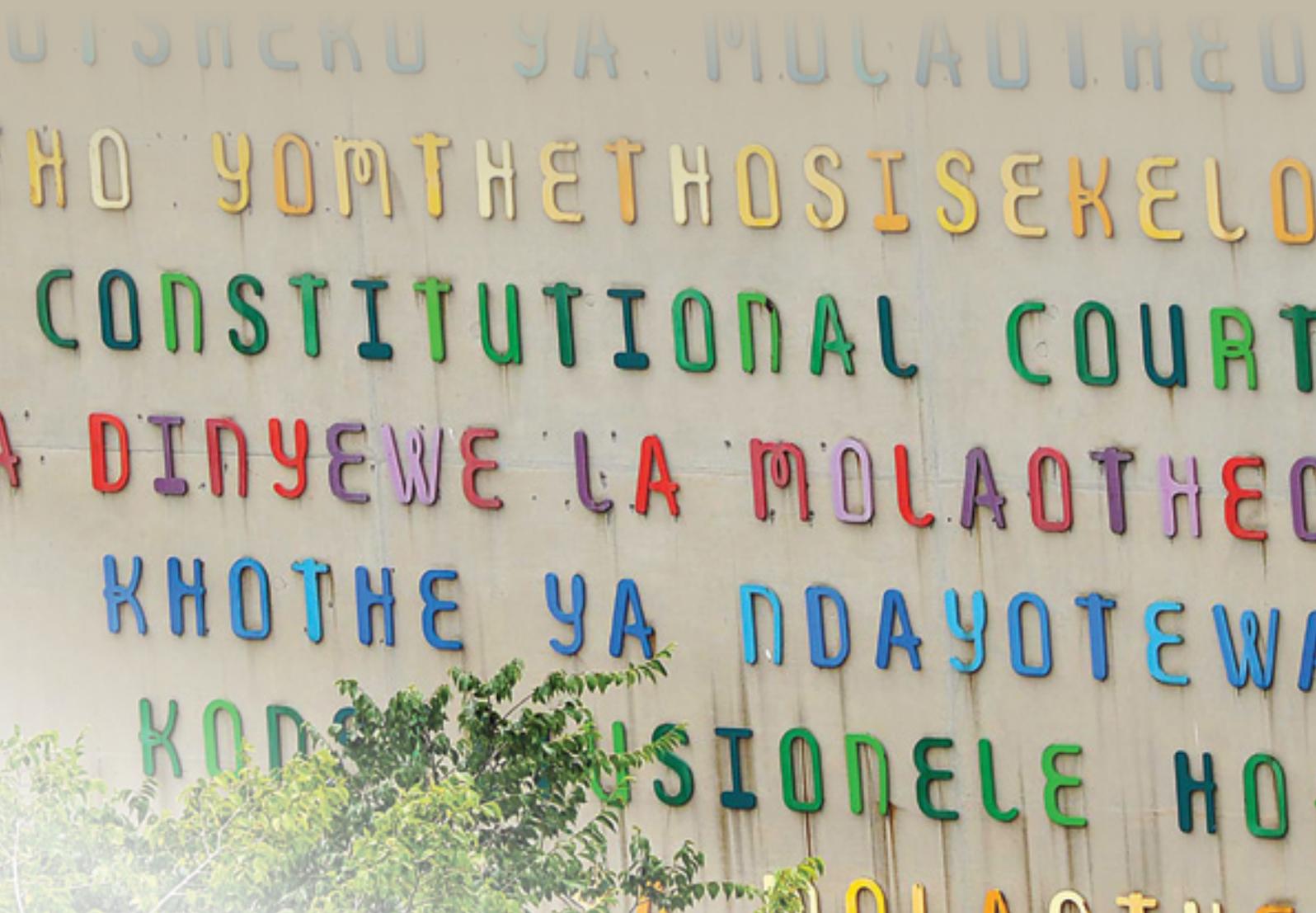
Sourced from Cape Connect: a joint project between the Centre for Film and Media Studies, and the Poverty and Inequality Initiative. Image by Vgrigas, Wikimedia Commons.





Peace, justice and strong institutions

SDG 16: Promote just, peaceful and inclusive societies



Gang violence exposes truth about lost generation

The Cape Flats is aflame yet again. The body count is climbing, as the gangs square off in yet another unwritten chapter of this interminable war.

Six-year-old Saadiqah Lippert died outside her granny's Athlone house, when she was caught in the crossfire between two warring gangsters.

The month before, it was eight-year-old Mbulelo and 15-year-old Linathi Ngcwanga, in Nyanga.

The protagonists are almost always young men, many still in their teens; warriors in an urban jungle where the police are often scared to enter – at least, not without tactical equipment, armoured vehicles and reinforcements.

That helps to explain why Cape Town, lauded as one of the world's most beguiling destinations, is also one of its deadliest.

But the headlines don't tell the whole story.

Don Pinnock will tell you the gangs aren't the problem; they are only symptomatic of a phenomenon that affects every one of us.

It's a story of a lost generation, of unloved youths who become young adults who are not just unemployed, but unemployable.

They teeter on the edge of the abyss, threatening to pull down the entire edifice around their ears. But there is hope. The situation can be reversed.

This is the central tenet of Pinnock's latest book, *Gang Town*: a searing, methodical study of the gang crisis in Cape Town, distilling 36 years of research, and forays into the ghettos and shacklands of places such as Mitchell's Plain, Lavender Hill and Khayelitsha, in a bid

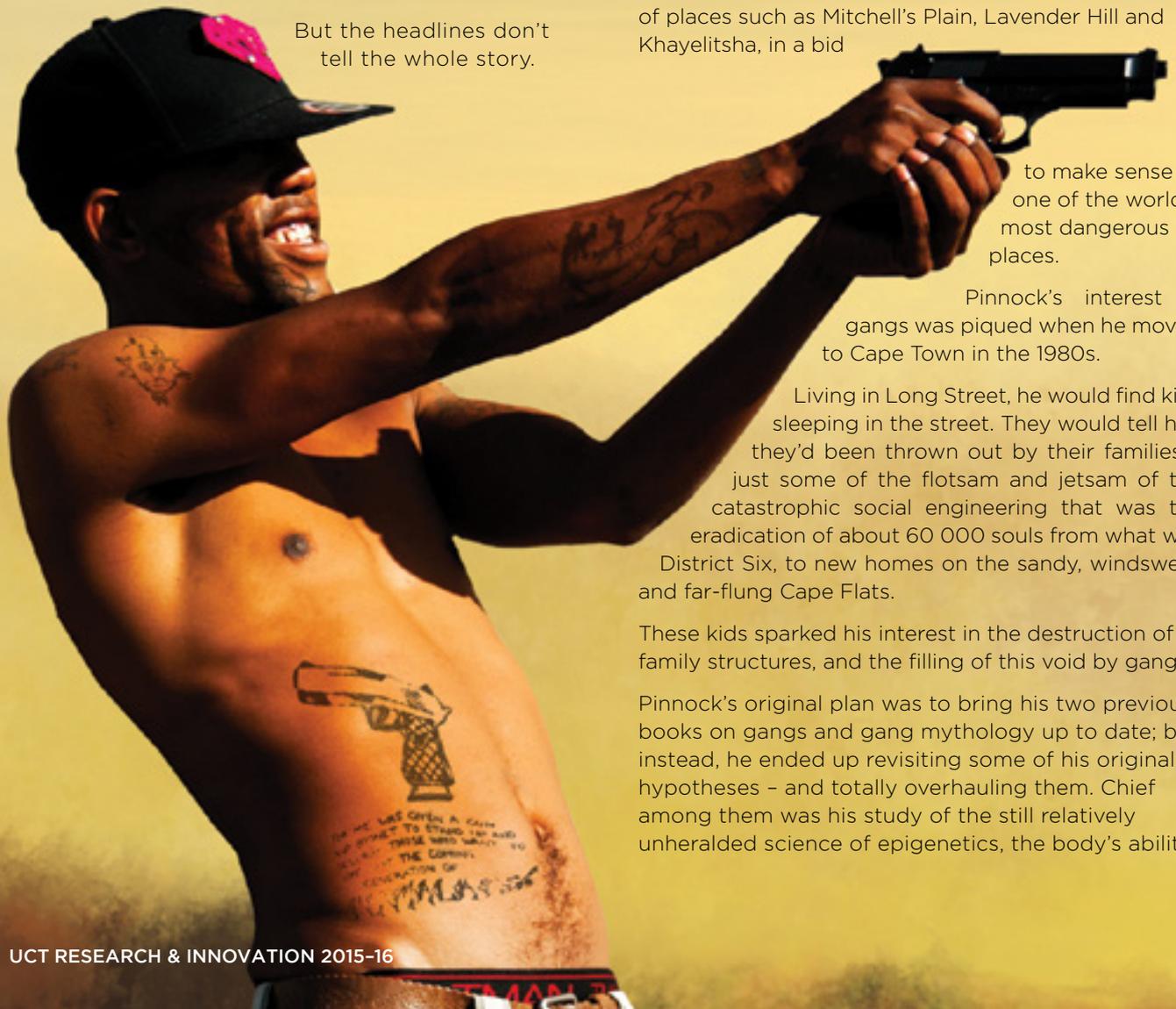
to make sense of one of the world's most dangerous places.

Pinnock's interest in gangs was piqued when he moved to Cape Town in the 1980s.

Living in Long Street, he would find kids sleeping in the street. They would tell him they'd been thrown out by their families – just some of the flotsam and jetsam of the catastrophic social engineering that was the eradication of about 60 000 souls from what was District Six, to new homes on the sandy, windswept and far-flung Cape Flats.

These kids sparked his interest in the destruction of family structures, and the filling of this void by gangs.

Pinnock's original plan was to bring his two previous books on gangs and gang mythology up to date; but instead, he ended up revisiting some of his original hypotheses – and totally overhauling them. Chief among them was his study of the still relatively unheralded science of epigenetics, the body's ability



to develop structures in utero and shortly after birth to enable it to survive in a hostile environment.

His thesis is that the embryo is formed by three distinct information systems: the father's DNA, the mother's DNA, and the environment in which the baby finds itself, both before and after birth – particularly when the mother is living in a high-stress and dangerous environment, probably taking drugs, not getting enough to eat or enough sleep. The end result, he believes, is a child growing up with a predisposition towards danger, drugs and gangs.

"The brain is saying 'build more dopamine, the high-stress stuff, be alert to danger, boost the warrior gene'," says Pinnock.

It's a thesis, he says, that "collapses the dichotomy between nature and nurture" – and, he grins, "puts a lot of strain on Darwinism.

"At the heart of the gang problem there might be a health problem," he says, "a higher propensity for risk-taking, using drugs, being violent."



Fatherless homes

The problem is exacerbated by the fact that most of the children are growing up in fatherless homes, which leads boys, in particular, to carry a sense of shame with them into adolescence. "They wonder: 'What did I do to make my father leave me?'"

This father-love to which they aspire is often found in gangs, where they act out their impulses even more violently to gain the approval of the gang leaders who fulfil that fatherly role.

Their drug use, too, Pinnock argues, is not purely addictive, but rather driven by the quest for a 'chemical hug', a temporary and fleeting replacement for the emotional attachment they've always craved, but never received. Drug use, he says, is driven by the user's innate sadness.

Pinnock's studies, this time, took him from the gangs themselves to a deeper study of adolescence and delinquency, given that most of the gang members were school drop-outs from broken families.

Delinquency, he found, was a natural state of all adolescent progression through to adulthood; indeed, the absence of it in an individual is actually the aberration, not the other way around.

The difference lies in the duration of the delinquency,

and its scope. Youths who grow up in relatively stable family units, where grandparents take on the parenting roles of extended families, and where they are loved, could turn out very differently to the kids next door – even graduate from university, while others are shot in the street as teens.

And to make matters worse, the entire system perpetuates the cycle. He reels off the statistics: a third of all Cape Town children are cared for by a single parent; a quarter have a parent or sibling who has been jailed; 15% lived in a household that had no working adult.

Don't get him started on education. "(Some) 317 331 kids on the streets don't get to matric - and that's just in Cape Town."

All of this pushes youth into gangs, where there is an outlet for their energies and rituals that give them acceptance, status and respect.

Cape Town, says Pinnock, has a youth problem of which gangs are a natural consequence, not the other way around.

Common-sense solutions

Pinnock's book also has solutions. Some of them are controversial; others, plain common sense. Like rethinking crime and punishment, instead of sending delinquents to prison to emerge as proper, hardened criminals; rethinking education towards creating young adults who are actually employable – particularly those who do get sentenced to jail; bringing back community nurses to do home visits to help young mothers raise their babies properly, particularly in the first few months after birth.

Pinnock's more controversial call is for the decriminalisation of drugs. He cites the success of Portugal in this regard, where levels of addiction were dramatically reduced and the market for illegal drugs eradicated – freeing police resources to pursue serious crime, while treating drug addiction as a health issue, not a justice issue.

Breaking the lure of the streets can only be achieved, he says, by giving young men back their identities and sense of self-worth. ○

*By Kevin Ritchie, Saturday Star.
Images from Gang Town. Gang Town by Don Pinnock is published by NB Publishers. Read an extract.*

Are our media holding our institutions accountable?

The media are often seen as having the potential to contribute to social progress on a number of levels. These contributions can be linked to several of the United Nations (UN) sustainable development goals (SDGs). The role that the media can play in deepening democracy, for instance, is often held up as an important justification for allowing the media freedom to criticise politicians and officials. The media are therefore seen as an important democratic institution that can contribute to SDG 16: the promotion of just, peaceful and inclusive societies, writes **Herman Wasserman**.

The idea that the media can act as the ‘fourth estate’ in society by acting as a watchdog over corruption and abuse of power is one that is entrenched in journalistic norms and in the popular imagination. The amount of space and airtime that has been given to the money spent on President Zuma’s Nkandla homestead is a good example of this type of journalistic work. According to this view, such reporting can assist democratic societies in reaching particular targets of SDG 16, such as ‘Substantially reduce corruption and bribery in all their forms’, and ‘Develop effective, accountable and transparent institutions at all levels’.

Despite the media’s claims to making these contributions to the deepening of democracy and the development of society, there is often disagreement about how well this ideal is translated into practice. Furthermore, there is much controversy around exactly what these roles should entail in the first place. For instance: what should the relationship be, exactly, between the media and government? Should a different role be expected of media in transitional democracies than we expect in established ones? How well do the South African media perform these roles? How should these contributions be measured?



Do citizens trust the media to hold government to account? Do citizens feel that the media represents their interests?

These are some of the questions that academic research in media studies seeks to answer, through both theoretical explorations and empirical work.

Media studies research can help to assess how well the media in a country such as South Africa are performing these roles. Critics of the media often point out that they are too elitist or commercially minded, and therefore fail to 'Ensure responsive, inclusive, participatory and representative decision-making at all levels', as described in one of the SDG 16 targets. The fieldwork conducted by a group of researchers (Professor Herman Wasserman, Dr Tanja Bosch and Dr Wallace Chuma, as well as several student research assistants) in the Centre for Film and Media Studies (CFMS) on an European Union-funded project called Media, Conflict and Democratisation (MeCoDEM) has shown, for instance, that the media does not pay enough attention to community protests aimed at giving communities greater say in policymaking. Poor communities often feel excluded from news agendas and have expressed frustration at not being listened to by journalists.

MeCoDEM involves research projects in four different countries, all transitioning from authoritarian rule to more democratic government – South Africa, Egypt, Kenya and Serbia – and the role of media and ICTs accompanying these transitions. Findings suggest that in all four countries, citizenship conflicts tend to be portrayed through a judicial or rights-focused lens, rather than with focus on social and cultural factors. The South African branch of the study reveals systemic problems underpinning news agendas and coverage.

Case studies covered by researchers from CFMS included media coverage of the ubiquitous community protests in South Africa, xenophobic attacks and conflicts erupting in parliament around the state of the nation address. The investigation into community protests included content analysis of major publications, and interviews with journalists and with community activists. Anger over unemployment, housing, water and sanitation, electricity, corruption and crime have all been listed as reasons for the rising number of protests, which started in the early 2000s. However, they are about more than just a struggle for basic public services; they are also an attempt by the poor to be heard and included in democratic discourse and policymaking.

According to protesters, media first ask if 'anything is burning' in order to decide whether it would be worth sending a journalist to report.



The study found that even in the media coverage of these protests, the voices of the protesters often remain unheard. Coverage of protests is often reduced to reports on traffic disruptions, and some communities report that photographers are often sent to document the protest without being accompanied by journalists to conduct interviews. Activists also told researchers that they only get media attention when they go to extremes. According to protesters, media first ask if 'anything is burning' in order to decide whether it would be worth sending a journalist to report.

This study reveals that while a free media has gone a long way towards ensuring democratic accountability in South Africa, there is room for improvement. Activists interviewed for the study said they believe the media could play a bigger role in boosting democracy, by highlighting the issues poor communities face before they spill over into violent conflicts. A focus on community could shine a spotlight on the most marginalised and vulnerable citizens, and help focus government attention where it is needed most, in order to achieve the SDG of creating a just, peaceful and inclusive society. ○

Herman Wasserman is professor of media studies in the Centre for Film and Media Studies. Feature image of Tahrir Square in Cairo by Jonathan Rashad, Flickr. Second image by Ramy Raouf, Flickr.



Why so few reports of rape end in conviction in South Africa

About 150 women report being raped to the police in South Africa daily. Fewer than 30 of the cases will be prosecuted, and no more than 10 will result in a conviction. This translates into an overall conviction rate of 4% to 8% of reported cases. In this edited extract from her new book, *Rape Unresolved: policing sexual offences in South Africa*, Dee Smythe explores why this is the case.

Attrition and discretion

For a range of reasons, attrition happens in the criminal justice system, so that not all reported cases are prosecuted and not all prosecuted cases result in conviction.

While attrition is to be expected in any functional criminal justice system, it occurs in an institutional context that is shot through with discretion. One scholar has gone so far as to suggest that: "... what we call the criminal justice 'system' is nothing more than the sum total of a series of discretionary decisions by innumerable officials."

The actions of criminal justice actors and the decisions they make are a crucial part of the attrition story.

The police decide whether to open a case, whether they will investigate it, and how much effort they will put into accumulating evidence and finding the perpetrator. It is their choice (whether they recognise it as such or not) to encourage a complainant in her efforts to bring the perpetrator to justice or to acquiesce in her withdrawal from the justice system. The police decide whether a case should be referred to the prosecution.

Prosecutors decide how to frame a particular set of facts as an offence – shaping a fit between what they can prove happened, and a set of elements that defines the conduct as criminal. They decide whether a case has sufficient merit to be taken to court, what evidence will be brought, who will be heard.

And ultimately, a judge decides whether the state will provide redress.

Throughout this process, manifested at key decision points, cases leave the criminal justice system. In this way, criminal justice actors have the power to select those whom the state will protect, who will be put on trial and who will obtain justice.

Stereotypes of what constitutes rape

Scholars studying attrition in rape cases generally explain the low rate of reporting and conviction in these cases by pointing to the stereotypical views held by criminal justice actors about what constitutes a sexual offence, and who can validly claim to have been victimised.

They argue that these beliefs have become scripted into criminal justice practice, with the result that the cases filtered out of the system are not those that are intrinsically weak, but rather those that offend the normative assumptions of decisionmakers.

There is empirical support for this contention. Studies conducted over the last 40 years have shown that the closer the fit between the facts of the rape reported and the decisionmaker's conception of what constitutes 'rape' (as opposed to 'bad' or even 'normal' sex), the more likely it is that the case will proceed successfully through the system.

On this account, 'violent' rapes committed by predatory 'strangers' against 'respectable' (for which read white, middle-class, married or virginal) women, who are injured while resisting, have become the paradigm cases against which all rape reports are measured in the criminal justice system.

Complainants who are perceived to have precipitated their own victimisation, whether through their conduct or their relationship to the perpetrator, are at a particular disadvantage.

Police's story

The police tell a different story. At least, in South Africa they do. Theirs is a tale of uncooperative victims. Police talk about complainants who cynically use the criminal justice system, fabricating or exaggerating rape complaints to further their own instrumental goals – of revenge or extortion, mostly – or to explain away their sexual misdemeanours.

The police argue that even when they are sympathetic and helpful, large numbers of victims withdraw valid complaints, refusing to cooperate in the investigation and prosecution of the aggressor.

These police officers have been through many hours of sensitivity training. They can reel off the 10 biggest rape myths, and they care about bringing rapists to justice; but they maintain that if complainants do not cooperate, there is little that can be done to pursue the case.

Their discontent runs along the following lines: investigating rape complaints is often a frustrating waste of time, and the effort required to investigate those cases needs to be weighed against other urgent organisational pressures and priorities, particularly in a resource-constrained environment such as South Africa. They argue that South Africa is fighting a “war on crime”, and the police are the vanguard. If rape victims are not serious about their own cases, they have only themselves to blame if they don't get justice.

Victim recalcitrance and systematic failures

The stories I collected in my research reflect evidence of both victim recalcitrance and systemic failures. They cannot be neatly parsed. A picture unfolds of attrition as deriving from the complex interaction of individual, structural and systemic factors.

While it is likely that the factors identified in my research share similarities with those of other, more developed countries, it is also arguable that many of them – and the way in which they combine – are reflective of the social and institutional dynamics of a developing country, and even more specifically, of the transitional post-apartheid South African milieu.

Why the blame game is unhelpful

Simplistic accounts of uncooperative and prevaricating victims on the one hand, and unsympathetic misogynist cops on the other, do not take us any further towards understanding the dynamics of rape attrition.

If the police are correct in their estimation, we are dealing with tens of thousands of deceitful women who are placing an intolerable strain on the system and its very limited resources.

If women's-rights activists are correct, the police remain deeply and irredeemably misogynist in culture and in practice. When nine out of 10 reported cases are not prosecuted (and two out of three are not even referred to the prosecutor for a determination), we are faced with a massive systemic failure that needs to be understood. When the numbers are as substantial as they are in South Africa, the problem becomes urgent.

Understanding this phenomenon is therefore at the centre of identifying ways to strengthen and develop police and civil society interventions, and to effect meaningful access to justice for victims of sexual offences. ○

Rape Unresolved: policing sexual offences in South Africa by Dee Smythe is published by UCT Press. Dee Smythe is a professor in the Department of Law.



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Why democracy should be taught in South African schools

Research has revealed that South African learners born after the end of apartheid, the so-called ‘born-free’ generation, are less supportive of democracy than their parents or older generations in comparable studies.

Worryingly, only 60% of students believed that democracy is always preferable, and only 45% said that it is important for them to live in a country that is governed democratically. However, the same study has shown that civic education has an important role to play in encouraging a ‘demand for democracy’ among South African youth.

Once factors such as economic background, family situation and gender had been controlled for, the results showed that race was not a determining factor. Rather, the most important influences were found to be linked to education: the depth of the students’ knowledge of democratic processes, the degree of discussion and debate encouraged in the classroom, extracurricular activities and their expectations of their future prospects for education all affected their desire to live in a democracy.

According to Robert Mattes, professor of political studies and director of the Democracy in Africa Research Unit, and lead researcher on the project, the study “sought to establish the relative impact of socialisation and education on young citizens’ political values and activities, and the extent to which schools can impart a critical, engaged democratic citizenship, despite the ongoing vicissitudes of unemployment, political divisions and social uncertainty.” Mattes concluded that “the extent to which Cape Town’s youths learn basic facts about the political system, develop an appreciation of the necessity for active, critical and lawful citizenship, and understand the importance of political procedures and institutions to democracy – all factors,

presumably, affected by schools and teachers – makes them far more likely to demand to live in a democracy”.

Knowledge of what constitutes a democracy was shown to be the single most important determining factor influencing students’ attitudes. “Students who know more about politics, both theoretically and practically, are likely to have read and heard more about democracy and about government in general, to have thought more often about history and politics, and to have taken part in more discussions and debates about the pros and cons of various ways in which governments are organised and run,” explains Mattes. “This greater interaction with political ideas is likely, we believe, to result in more positive judgments about democracy; and correspondingly, more negative views about autocratic forms of governance.” While students’ family situations may play a role in their knowledge of politics and governance, these results make a powerful argument for ensuring that high-school students are exposed to civic education classes.

The success of a democracy depends on the vigilance of its citizenry. As those active citizens who fought apartheid grow old and die, it will be up to the new generation of citizens to safeguard the country’s hard-won democratic freedoms, explains Mattes. For this reason, it is vital that the South African curriculum includes a greater focus on understanding democracy and promoting civic activism. ○

By Ambre Nicolson. Image supplied by the Schools Improvement Initiative.





Zero hunger, sustainable cities and responsible consumption

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG 11: Make cities inclusive, safe, resilient and sustainable

SDG 12: Ensure sustainable consumption and production patterns



Image by World Bank, Flickr.



African urbanisation: trends and prospects

The next two to three decades will define Africa's urban transition, not least because of the massive expansion in the number of people living in these cities. Africa and Asia are the two most populous world regions, and the least urbanised. While all regions globally are expected to urbanise further over the coming decades, Africa and Asia are urbanising faster than the other regions, and by 2050 are projected to become 56% and 64% urban, respectively. African urbanism will be increasingly on the global development agenda, specifically in light of the urban sustainable development goal (SDG) and the New Urban Agenda (Habitat 3), write Edgar Pieterse, Sue Parnell and Gareth Haysom.

Differential urbanisation trends in Africa

While it is important to have a uniquely African perspective within the global debate on the New Urban Agenda, it is essential to acknowledge the diversity of African urbanisms. There is enormous variation in the levels and rates of urbanisation across the continent. Importantly, while much of the policy attention in the past has focused on Africa's primary cities, much of the continent's urbanisation is taking place in smaller, secondary cities.

As the role of the urban in African development is contemplated, there are four key issues that must be considered.

The youth bulge: Fifty percent of Africa's population is presently younger than 19. This youthful population

points to continued population growth until the end of this century. The 'youth bulge' means that Africa's labour force will probably treble between 2000 and 2050. However, at present, just 28% of the labour is in stable, wage-earning jobs. How will all of the new entrants into the labour market be absorbed into stable jobs if the current economic growth path is not altered radically?

Access to infrastructure: African cities are characterised by poor infrastructure, coupled with under-capacitated natural resource management. This puts poor urban populations at risk, not just in terms of major events associated with climate change, but also everyday exposure to air, water and soil pollutants.

Despite recent positive economic growth in Africa, the limited infrastructural footprint presents a binding constraint to continued and high growth. The deficit in

infrastructure capacity, combined with acute financing challenges, create significant prioritisation pressures. African countries will have to find innovative solutions to ensure that the basic needs of their citizens are met, while creating the infrastructural platforms for growth.

The scale/governance disconnect: Due to the predominance of informal economic life, combined with thin local institutional systems, the tax base for urban investment is inadequate to meet the vast needs of cities. National governments perceive these conditions as justification for the continued national control and management of urban areas. The net effect is that there is no coherent strategy or investment programme to address urban management imperatives across the diverse needs of the national settlement/urban system.

The economy: There is a need to promote an Africa-focused development agenda amid the series of interlocking dynamics of distorted urbanisation across Africa, which have their roots in both colonial economic policy and structural adjustment policies. Currently, most African countries focus economic policy on gross domestic product (GDP) growth, even if this does not generate large numbers of new jobs or is environmentally damaging. A narrow fixation on GDP growth undermines long-term development ambitions. Inclusive growth points to the imperative of establishing economic growth trajectories that are highly labour-absorptive, and afford access to decent work.

The African urban agenda

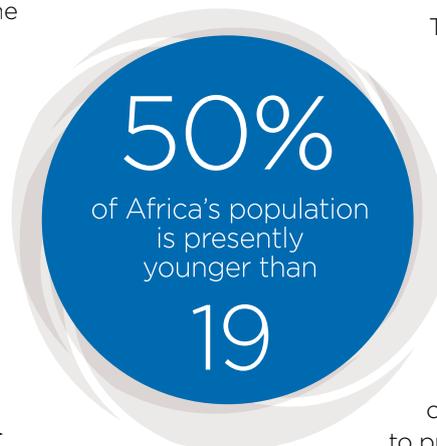
For most African countries, development challenges are great, because national economies tend to be small and are inserted into global value chains under adverse conditions. Furthermore, these economies are often overly reliant on a single commodity, which places the national fiscus at continual risk. Therefore it is vital that African governments and citizens debate how these structural obstacles can be overcome in the context of a commitment to greater regionalism, intra-regional trade, and endogenous industrialisation to supply the goods and services of the domestic populations. Cities can kick-start these debates.

One pathway is a focus on resilient growth, in which the green economy is viewed as the necessary gateway to a low-carbon and resource-efficient future. This requires changes in the nature of production and consumption so as to radically reduce the harmful emissions associated with the current economic system, and to delink each unit of economic output from non-renewable resource inputs. Embracing a resilience-oriented growth path

is a tough requirement for African economies that are predominantly reliant on extractive industries for trade and foreign exchange. Yet, as the world moves towards a global carbon-trading and -taxation regime, and more stringent environmental standards linked to trade agreements, economic competitiveness will depend on getting this right. Africa's advantage in the new post-2015 focus on resilience is that the relatively low levels of economic development mean that these systems are not yet locked into unsustainable pathways. There is therefore an unprecedented opportunity to use the imperative to build massive infrastructures in African cities and regions as a catalyst for embedding the green economy.

This opportunity, however, requires new ways of thinking that challenge the logic of the established northern model of urbanism as an ideal for African cities to aspire to.

Neither inclusive nor resilient growth is possible if Africa's human potential remains untapped and underinvested. Education and health are the two most important drivers of human capital formation, along with social safety nets, as the economy of a country expands. The skills and knowledge of the urban workforce are a central determinant of the dynamism and long-term durability of growth.



Those who live in and manage African cities need to drive the global conversation about what sustainable urban development means in practice. Furthermore, the real-life innovations to achieve sustainable urbanism will come from the ground and cascade upwards. Technocratic top-down programmes and solutions will not work, because each city and town is unique and will need to draw on the collective resources of all actors affected to produce fit-for-purpose reforms. However, local innovations become a lot easier if there is a coherent and high-profile national programme of action to drive systematic urban transformation.

The ideals of good governance, democracy, respect for human rights, justice and the rule of law must be forged in the hurly-burly of Africa's cities, otherwise they will never take root. It is in these settings that the new, youthful interpretation of Africa's cultural identity, common heritage, values and ethics will be made manifest through art, culture and media. ○

Professors Edgar Pieterse and Sue Parnell and Dr Gareth Haysom are researchers at the African Centre for Cities (ACC). Professor Pieterse is the DST/NRF SARCHI Chair in urban policy and director of the ACC. Image of Kumasi Market in Accra, Ghana by Latitude Canada, Wikimedia Commons.

Three ways to encourage affordable housing in the inner city

The need for affordable housing in Cape Town's inner city is hard to overstate. Right now, the city's lowest income group spends roughly two hours a day and at least 15% of their monthly salary on getting to and from work. In other words, the people who can least afford it are the same ones who have to travel the furthest and pay the most to get to their workplaces.

A new paper produced by the Department of Construction Economics and Management identifies the challenges presented by the lack of affordable housing in Cape Town's city centre – and some possible solutions.

“Right now, there's a significant backlog in the supply of units,” explains researcher and land economist Robert McGaffin. “Apartheid planning resulted in fragmented and sprawling cities, and in Cape Town this is exacerbated by the fact that land close to the city centre is particularly expensive.”

So what can be done to encourage the development of more affordable housing in the inner city?

McGaffin, along with co-authors Francois Viruly, Mark William Massyn and Nicole Hopkins, argue in their 2015 paper that development costs such as land acquisition,

construction costs, financing and marketing must be balanced by the need to create a product that is truly affordable to a lower- to mid-income market. According to the paper, both realistic economic factors and policy changes have a part to play in increasing the viability of affordable housing.

Greater density

Increasing the height of buildings and dividing developments into smaller units can help improve the ratio between development costs and profitability for property developers, while still keeping housing affordable.

“There is a perception that South Africans are unwilling to consider smaller living spaces; but I think the



phenomenon of backyard dwellings, in which people are willing to pay for cramped accommodation because it is well located, shows that is not the case,” McGaffin says. “In places like inner-city Joburg, the private sector is renting out 15m² spaces, at a rate of 98% occupancy.”

Less onerous buildings standards

According to McGaffin, the cumulative effect of very stringent building standards has been underestimated as a stumbling block to affordable development.

“Obviously it’s very important for standards to be in place when it comes to human habitation; but a balance has to be struck between making buildings safe to live in and making them affordable. Otherwise, a few will get to live in safe spaces, while those who can’t afford it will be forced to live in dangerous buildings. If it’s just a case of red tape, then simplifying these standards could have a positive effective on the viability of affordable developments,” he says.

Use of existing building stock

Repurposing existing stock into low-cost housing would allow significant savings to be passed on to lower-income households. “We have a habit, locally, of using the most expensive type of development

method, namely new builds, to try and cater for the lowest income segment of the market,” McGaffin says. As the paper puts it, “Not only are existing buildings cheaper, but they also make up the bulk of the built stock in the city, and therefore represent the best opportunity to deliver affordable housing at scale.”

How does McGaffin see the situation changing in the future?

“I’m quite positive,” he says. “I think a lot of the suggestions in the paper are things that are already starting to happen.

“Also, the good news about a slowing economy is the fact that it can put the brakes on property prices. I think in the next several years we will see a slowing of the commercial market, and this may free up some already existing stock to be repurposed into affordable housing.”



By Ambre Nicolson. Main image by ign11, Flickr. Image (above) by Pixabay.

Embedded research offers young researcher greater insight

City officials are sometimes so close to what they’re doing, they can’t see the wood for the trees; while academics work in a theoretical world, where it is easy to lose sight of the practicalities on the ground.

To bridge the divide between the academy and practice, four UCT researchers spent three years (from 2012 to 2015) ‘embedded’ within city council departments, to observe how policy is developed and implemented. Robert McGaffin, Anna Taylor, Saul Roux and Anton Cartwright – all linked to the [African Centre for Cities \(ACC\)](#) – took part in this knowledge transfer project sponsored by Mistra Urban Futures (MUF).

Robert McGaffin focused on the city’s space economy within the Spatial Planning and Urban Development Department. He noted that while city officials were closer to the ground and understood what the priorities were, academics could help define the problem, to reach a better understanding of the underlying causes.

Anna Taylor looked at climate-related risks in the Environmental Resource Management Department and the Stormwater Sustainability Branch. She praised this ‘embedded’ model of research. “The conversations that (we) had definitely hugely enriched my understanding of some of these policy and academic ideas – I suddenly saw them through different lenses.”

Saul Roux focused on urban energy governance in the Energy and Climate Change Unit. He said one of the benefits of the project was that value was added by sharing research interests across different disciplines.

Anton Cartwright, whose project focused on the green economy, said the ideas he worked with throughout the three years were ways the green economy could be linked to economic theory and then translated into budget. “Someone said to me, if you don’t exist in the budget, you don’t exist in the City,” he observed.

Read the full story [here](#).

Governing safer cities in a globalised world

How does Cape Town mayor Patricia de Lille, with the resources of a medium-sized South African city, take on – for example – the Chinese mafia, who are flooding Cape Town with drugs in exchange for illegally harvested abalone? The impact is greater drug use, violence and exclusion among the city’s poorest and most marginalised residents.

De Lille is not alone in having to tackle global criminal networks within a local context, and seeking to forge better cooperation with national government: illicit flows of goods and people, and the criminal networks that accompany those flows, are increasingly interwoven with local vulnerabilities in cities around the world. City governments are often faced with insecurity derived from global flows – and face serious challenges in responding to them.

Violence and criminality in cities manifests in multiple ways. It does not always start with criminal gangs; but often, with a growing proliferation in non-statutory security forces such as private security companies, or political-party militias. These forces usually develop from the margins: from populations neglected by the state. But once these groups have established a control over a given territory, they need to find the means to sustain and commodify it. This opens the

space for local groups to start making contact with global criminal networks, to cash in on global illicit flows. These include the flow of weapons, drugs, humans, and even environmental products such as rhino horn and abalone.

These criminal networks undermine human development, good governance and the life chances of the people who live in the affected cities.

Making cities safe

United Nations (UN) sustainable development goal 11 seeks to make cities inclusive, safe, resilient and sustainable; to this end, the UN Office on Drugs and Crime (UNODC) tasked the Centre for Criminology to develop a framework to guide policymakers on how to build safer cities in a globalised world. This report,

Failure of regulation in the taxi industry

The high level of violence in the taxi industry is an excellent example of failure of regulation by the state. The taxi industry in South Africa is essentially a mafia organisation that regulates itself through violence. According to Shaw, the majority of criminal assassinations in South Africa are related to the taxi industry.

which pulls together research from 10 cities from around the world, argues that the global flow of ideas, illicit products and other commodities has an enormous impact on the security of cities. In order to respond to this global challenge, policymakers first need to understand the ecosystem of these global flows and how they interconnect with the local situation; and then respond strategically and holistically, through a safety governance approach.

“Cities that fail will mean a global community that fails,” reads the opening paragraph of the report. Currently, more than 54% of the world’s population live in cities, and urban populations are expected to grow at a rate of 1.5% to 2.0% a year. What this means in practice is that unsafe cities will constrain the life chances of millions of people around the world, says Professor Mark Shaw, director of the Centre for Criminology and DST/NRF SARCHI Chair in Security and Justice, who led this research project. But law enforcement strategies alone will not ensure the safety of those cities. Instead, Shaw stresses inclusion as the central concept.

Including marginalised groups

“It is those same people who are disconnected from the global economy who are most likely to be linked to its dystopian side. Law-enforcement interventions will only exclude them further,” says Shaw. The core challenge then for cities is to ensure, through spatial planning, the provision of services and a constant process of engagement, so that all citizens of a society are drawn as far as possible into its benefits.

Organised crime groups cannot easily take root in areas where governance is strong and society is robust; but where the state is weak or absent, the space is opened up for criminal groups to gain traction.

When these criminal networks fill the space left by weak governance, local communities and individuals may come to view them as an alternative

to legitimate government. When this happens, the criminal networks generate legitimacy and loyalty from the local population. In these cases, use of force may well exacerbate violence and further alienate affected communities from the legitimate state and broader society.

Safety governance

The safety governance approach, proposed in the report, thus seeks to enhance the well-being of people and communities through appropriate management and allocation of resources across a city. The proposed approach encapsulates better regulation of legal activities in which criminal activities often take hold, such as in bars, nightclubs and hotels (for sex trafficking); better community-driven law enforcement, which upholds human rights and the rule of law; greater engagement by city officials with all groups in society; and innovative thinking by policymakers, to reduce vulnerability and build resilience within the fragile communities of a city. The result of the safety governance approach is that all members of society benefit from the economic and social development of a city. ○



“It is those same people who are disconnected from the global economy who are most likely to be linked to its dystopian side. Law-enforcement interventions will only exclude them further.”

By Natalie Simon. Image by Deutsche Gesellschaft für Internationale Zusammenarbeit, Violence and Crime Prevention.

The consolidation of criminal networks

Homicide rates are a key indicator of levels of violence in a society, and can be used to measure the extent to which criminal groups are consolidating power.

Cape Town has a very high murder rate, 65 per 100 000 people (compared to Johannesburg’s 33 per 100 000 and Tshwane’s 19), partly because there is a process of consolidation by criminal networks happening in Cape Town. One example is the illegal abalone trade. Chinese triads partner with gangs to trade abalone for tik (a local form of methamphetamine). These partnerships are maintained with a high degree of violence as gangs compete for turf.

One way in which the Centre for Criminology monitors this consolidation is through the media. A local newspaper may run a small story on two people being shot dead in a small town on the west coast; but researchers will recognise the killing of a gang-leader or middle-level player as part of a greater war.

Governing food systems to alleviate urban food insecurity

As Africa urbanises and the locus of poverty shifts to urban centres, there is an imperative to address poverty and its associated problem – urban food insecurity – in African cities. The global development agenda is increasingly focusing on urban issues; most notably, the urban goal of the new sustainable development goals (SDGs) and their New Urban Agenda. Despite the centrality of food to the health and well-being of urban residents, and the role of the food system in the local economy, there has been relatively little research on urban food security or urban food systems in the African context. There has also been little attention paid to the governance of the urban food system to the ends of alleviating urban poverty, and to the role of urban planning in achieving this, write Jane Battersby and Gareth Haysom.



The food research cluster at the [African Centre for Cities](#) (ACC), consisting of three urban food-focused projects ([AFSUN](#), [Consuming Urban Poverty](#), and the [Hungry Cities Partnership](#)), seeks to address these gaps. Since 2008, the food cluster has sought to contribute to academic knowledge and debate on urban food security and food systems. Aligned with the mission of the ACC, the food projects seek “to facilitate critical urban research and policy discourses for the promotion of vibrant, democratic and sustainable urban development in the global south from an African perspective”. We therefore focus on generating new knowledge for peer-reviewed academic publications, but also explicitly seek to engage popular debates through media and social engagement, as well as generating policy-relevant documents.

Five key messages have emerged from the work conducted by the ACC’s food cluster:

- Food insecurity is not simply a rural problem. It therefore requires policy sensitive to the unique challenges of urban food security, and governance structures that enable local government to respond to food insecurity.
 - The nature of food insecurity is shifting rapidly, with overweight status and obesity emerging as new forms of food insecurity, while malnutrition persists. But continental policy responses do not address this changing reality.
 - Food insecurity needs to be understood as the outcome of the structure of the food system and the urban system, and therefore requires policy responses that extend beyond household-scale interventions, such as the promotion of urban agriculture.
- Urban food insecurity is also in very large measure attributable to the changing economy in the urban food supply system, i.e. the supermarketisation of food supply, along with the erosion of opportunities for informal and smaller food-supply outlets, which in the past were a major source of supply to poorer households. This requires critical engagement with notions of ‘development’ in urban areas, which assume modernisation and formalisation with poverty alleviation.
 - Important contributions to debates on urbanisation in sub-Saharan Africa, the nature of urban poverty, and the relationship between governance, poverty and the spatial characteristics of cities and towns in the region, can be made through a focus on urban food systems and the dynamics of urban food poverty.

Through working first locally and then scaling up to international policy fora, the researchers in the food cluster have succeeded in embedding these core messages in a number of policy arenas. The team has written a *Food Security and Food Systems Report* for the City of Cape Town and an Urban Food Security Report for the South African Cities Network, engaged in meetings with provincial and national government on food strategies and policies, and contributed to FAO ([Food and Agriculture Organisation of the United Nations](#)), UNEP ([United Nations Environment Programme](#)) and UN Habitat processes; most notably, working as part of the Expert Group Meeting on Integrating Food into Urban Planning, which then informed the various drafts of the United Nations New Urban Agenda document. 

By Drs Jane Battersby and Gareth Haysom, researchers at the African Centre for Cities. Image by Jane Battersby.

The new face of food insecurity

“It’s been a long day,” thinks Bulelwa Tafeni. It always is. As usual, she got up at 5am to get to her cleaning job in the suburbs on time. As usual, all she had before she left was a cup of coffee with condensed milk. As usual, her elder child took the younger one to the unregistered neighbourhood childcare on her way to school. At least both of them get breakfast at school. But today, as she sits in the minibus taxi waiting for it to fill up before it can go, she is hungry. She’d been hungry when she left work, and that was a bus ride and a taxi ride ago. It’ll still take another hour to get home.

It is a week until she gets paid again. On payday, the first thing she does is go to the supermarket near to where she works, to buy bulk non-perishables for the month. The food is cheaper and better quality than the same food near her home, even in the supermarket that has just opened up. She would also buy meat and fresh produce, but she doesn’t have refrigeration, or storage space, so it would go to waste. She has to pay for a second taxi seat for all the food, but that’s OK. But now, as usual, the food has run out, and money is scarce. She has cut down on the range and quality of the food she feeds the family, she has reduced meal sizes. Now is the hungry time.

Bulelwa Tafeni is not a real person; but she represents the new face of food insecurity – a problem that is increasing rapidly in urban areas.

Southern African tourism: the ‘multiplier’ effect

For every night that a tourist stays over at a high-end game lodge in a remote part of southern Africa, 14 people in the surrounding community benefit indirectly from the income generated by the services offered by the industry. As lodge staff send their remittances back home, the money circulates within these rural communities, helping to grow the local economy.

This is the finding of Dr Sue Snyman, a tourism analyst and economist associated with UCT’s Environmental Policy Research Unit (EPRU), in the Faculty of Commerce.

“This is the multiplier effect of tourism in remote regions of the subcontinent,” explains Snyman, who has published several papers in the past year on the basis of the findings of her 2013 doctoral thesis.

During her doctoral work, in which she surveyed 16 different eco-tourism lodges in six southern African countries, Snyman found that for every one person employed by these lodges, seven people benefit directly from the downstream flow of that income.

“The staff employed in these sorts of ventures help grow the local economy – by spending their wages at community stores where they do their grocery



shopping, for instance,” says Snyman. “Or they drive secondary employment through hiring people for childcare, or to tend their livestock while they work. Or they’re sending their children to school.”

The survey, conducted in South Africa, Botswana, Namibia, Zambia, Zimbabwe and Malawi, found that staff were earning, on average, US\$278 dollars per month – which flowed to direct dependents, but then also continued to circulate within the local economy, and stimulated other employment opportunities.

Snyman, who works with private tourism operator Wilderness Safaris in various capacities, included some of this organisation’s lodges in her surveys.

“If you were to extrapolate the findings from the lodge staff that I interviewed, to encompass all 683 people employed at the places where I did the research, that means that 4 781 people are downstream beneficiaries of those pay cheques.”

“This has a huge economic impact. These wages help to build human capital in rural areas where there aren’t many other economic opportunities,” she says.

However, in terms of the development implications of tourism and its potential to help create educational and economic prospects for these far-flung communities, Snyman maintains that it is still important for civil society organisations, the private sector and government to invest in capacity-building within these communities, so that they can become equal and well-equipped partners in tourism ventures.

This is key, particularly if tourism ventures want to bring local communities into partnership arrangements in running lodges and concessions.

“If we want people to thrive in businesses like this, we need to be sure we don’t try to get local communities to run before they can walk. People need to be trained in bookkeeping, management and accounting. They need to understand the industry; for instance that if someone spends US\$400 a night, that isn’t a clean US\$400 profit; expenses need to be covered first.”

Individuals hoping to work in the sector need to understand the role of marketing and communication, as well. Snyman’s observation is that many development projects in this sector don’t invest enough in this sort of capacity-building in their development work.

‘Inclusivity’: the new ‘sustainable tourism’

These downstream benefits of tourism can be measured in clear economic terms, but the social, environmental and political impacts are also key to driving ‘inclusive growth’ for the rural communities getting involved in tourism.

“The term ‘inclusive growth’ is a relatively new one in the tourism sector,” Snyman explains, maintaining that it has gained traction recently as other terms, such as

‘pro-poor’, ‘responsible tourism’ and ‘sustainable tourism’ have lost their momentum.

“An example of the social benefits would be the improved infrastructure and services that come to an area when, for instance, a new lodge is built. Often, when tourism comes into an area, the roads are upgraded, and mobile phone networks come into the area. Sometimes you even have clinics being built.”

Local residents can also benefit from the education that might come as people are trained up in aspects of tourism, such as lodge management or bookkeeping. Others might benefit from the empowerment that comes with being part of joint ventures or becoming tourism operators themselves.

Inclusion from an environmental perspective could be because land is now conserved, and isn’t used for mining or agriculture. There might also be a reduction in poaching as communities see the benefit of conservation, meaning animal numbers might improve.

“If water sources inside a park are well-conserved, that can improve water quality outside the park, where communities extract water from rivers, for instance.”

Sectors need to work together

But tourism in the Southern African Development Community (SADC) is being held back, largely by failures in other sectors.

“The problems that operators have with travellers’ flight schedules, for instance, originate in the transport sector,” Snyman argues.

Meanwhile, problems such as poor communications originate in the information and communications technology (ICT) arena; and visitor visa hurdles must be resolved by member countries’ home affairs departments. These problems with infrastructure, transport, and visas and customs policies are all inhibiting growth in the sector.

Resolve those, Snyman argues, and tourism across the region will take off, bringing with it the potential to meet some of the region’s poverty-alleviation and development challenges. ○

By Leonie Joubert, freelance science writer. Images by Wilderness Safaris.



Talk of sustainability is just lip service

Mining creates waste, which causes social and environmental harm, particularly water contamination and air pollution. The consequences are often insidious and the harm becomes obvious only decades later, as with silicosis and acid mine drainage in South Africa, write Hanri Mostert and Cheri Young.

Silicosis, an incurable lung disease caused by the inhalation of dust, is so prevalent that it is classified as a public health issue. Acid mine drainage, caused by the release of sulphuric acid from minerals such as pyrite into the water table, is a leading cause of water pollution.

There is an uneasy relationship between reaping the benefits of extractive activity and assuming responsibility for its consequences. Mining, by its nature, is destructive and waste-producing.

The cost of mitigating the harm – medical treatment or environmental clean-up costs – is likely to be borne by the state, and therefore society. This is apparent, for instance, in the example of the silicosis settlement. About 4 400 mine workers with silicosis may have found some relief in the US\$30m settlement of their claims with Anglo American SA and AngloGold Ashanti, but many more have not: thousands of other ill miners are still seeking relief, with an approved class action on the cards.

The interests of promoting society, preserving nature and boosting the economy will always be competing. Environmental destruction in the name of economic and social development seems inevitable; conversely, environmental preservation will impede societal and economic development.

The magnitude of the task of balancing these interests makes calls for ‘sustainable’ mining seem like empty rhetoric. Still, it is beyond argument that the sustainable use of natural resources will contribute to the longevity and prosperity of the human race.

Sustainability has increasingly appeared in legal frameworks around the globe. The notion of ‘sustainable development’ has been catapulted into mainstream thinking, and has become integral to business strategies. But frequent talk of sustainability, particularly in the business sector, may feed the belief that its tenets are being realised. They are not.

We can make forecasts about the future, particularly in respect of economic gains, but we cannot predict with any certainty the true extent of the environmental and social damage. This means the creators of regulatory frameworks for extractive activity must be aware that environmental and social harms may present long after operations have ceased. Regulatory intervention is necessary, but not sufficient. A multifaceted approach is needed. This is particularly evident when dealing with mining waste. How we achieve optimal sustainability depends on the variables of the time, and thus our approach to sustainability needs to be adaptive. Mine waste – dust and water contamination – is an issue that will eventually affect all of us.

It is time for society to choose the best response to these man-made problems. It is time for us all to take responsibility. 

*Professor Hanri Mostert is the DST/
NRF South African Research
Chair for Mineral Law in Africa;
Dr Cheri Young is a lecturer
in the Department of
Private Law. This story
was first published in
Business Day Live.
Image by Daylin Paul,
Sunday Times.*





Good health and well-being

SDG 3: Ensure healthy lives and promote well-being for all at all ages

Biomarker discovery offers hope for new TB vaccine development

A team of scientists from UCT, Oxford University and the London School of Hygiene and Tropical Medicine have made a discovery that reveals how we can improve development of more effective vaccines against TB.

TB is the biggest killer of humans due to bacterial infection. In 2014, 9.6 million people were diagnosed with TB, and 1.5 million died. The only available vaccine against TB, BCG, is given to infants to prevent severe forms of the disease; but protection against lung disease is very variable – particularly in countries where TB is most common, such as South Africa.

The research team studied young children who had previously participated in a large clinical trial of a new TB vaccine conducted in Worcester, in the Western Cape. They investigated the immune response to BCG, given at birth, to determine the characteristics of this response that are associated with protective immunity against TB. “We looked at a number of factors that could be used as immune correlates, to try and find biomarkers that will help us develop a better vaccine,” said Professor Helen McShane of Oxford University, who led the study. The team carried out tests for 22 immune-response characteristics, and found that elevated activation of CD4 T cells was linked to higher TB disease risk. Higher levels of T cells, that responded to the BCG vaccine by producing IFN, the immune messenger molecule, were linked to reduced risk of TB.

Antibodies to the Ag85A protein made by the TB bacterium were also identified as a possible immune correlate. Higher levels of antibodies targeted against Ag85A were associated with lower TB risk. However, the team cautions that other environmental and disease factors could also cause Ag85A antibody levels to rise, and so there may not be a direct link between these antibodies and TB risk.

TB is an international killer

Professor McShane said: “These are useful results, which ideally would now be confirmed in further trials. They show that antigen-specific T cells are important in protection against TB, but that activated T cells increase the risk.”

Associate Professor Tom Scriba, from the South African Tuberculosis Vaccine Initiative (SATVI) at UCT, said: “TB is still a major international killer, and rates of TB disease in some areas of South Africa are among the highest in the world. These findings provide important clues about the type of immunity TB vaccines should elicit, and bring us closer to our vision – a world without TB.”

Dr Helen Fletcher, from the London School of Hygiene and Tropical Medicine, said: “For the first time, we have some evidence of how BCG might work – and also, what could block it from working. Although there is still much work to do, these findings may bring us a step closer to developing a more effective vaccine for TB.”

The team is continuing its work to develop a new and improved TB vaccine, with the aim of protecting more people from the disease. 

The research paper [T cell activation is an Immune Correlate of Risk in BCG vaccine infants](#) was published in Nature Communications. (Download [media statement](#).) By SATVI. Image by Yale Rosen, Flickr.

Inflammatory proteins offer insights into how TB spreads in the lungs

Two scientists at UCT have found proteins in the body that help the bacteria that cause TB to spread.

“Our research looked at one component of the immune system, and found that there were proteins in the body that promote lung inflammation – which helps the bacteria that cause TB to spread throughout the lung,” report Hlumani Ndlovu, senior postdoctoral fellow in TB Immunopathogenesis, and Mohlopheni Marakalala, senior lecturer and group leader in the Division of Immunology.

“Now that we have identified the proteins associated with disease progression, the next step is to find the drugs that will inhibit these proteins, and limit lung inflammation.” [Read more.](#)

Image by Michael Hammond.



Low-cost urine test reduces HIV-associated TB death rate

A UCT-led clinical study on a urine test able to diagnose TB in severely ill HIV patients has led to a call for its immediate use in public health programmes, because it has the potential to save lives.

In a randomised controlled trial of the LAM urine test in 2 600 patients in South Africa, Zimbabwe, Zambia and Tanzania, the study evaluated the usefulness of using the simple diagnostic test (similar to a urine pregnancy test) to guide treatment in severely ill HIV-infected patients with suspected TB. The test – which can be conducted by a minimally trained healthcare worker, at the bedside – results in a diagnosis in around 25 minutes, simply from putting a few drops of urine on a low-cost test strip.

“Using a randomised controlled trial design, the study found that compared to existing tests and approaches used to guide treatment, the LAM test reduced the TB death rate in hospitals by almost 20%. Significantly, these were results obtained using a rapid, simple-to-use, low-cost bedside test,” comments Professor Keertan Dheda, the study’s lead investigator. [Read more.](#)

Image by Alere Inc via [Discovery Medicine](#).



Living in the city: how environment affects health

For the first time, more than half of the world's population lives in urban settings. Many African countries are experiencing rapid, unplanned urbanisation, resulting in a significant proportion of urban dwellers living in informal settlements. A simplistic notion of urbanisation envisages people moving into denser areas with better access to healthcare and improved socioeconomic determinants of health, such as education and employment opportunities. However, the urban poor, who mostly live in such environments, are often exposed to worse conditions than in rural areas. This is exacerbated by the relative deprivation and spatial and environmental discrimination that accompany vulnerability. To improve inhabitants' and communities' health and well-being in a changing urban environment, it is important to understand the key factors and determinants that contribute to a healthy city, writes Tolu Oni.

The health and well-being of people living in cities and towns is intricately linked to the natural, built and institutional elements of the urban environment. In a changing urban environment, we need to consider all dimensions of urbanisation and urban living, as well as key social determinants of health. These include access to housing, health services, transport, food security, potable water, physical and environmental safety, social welfare, community resilience and psychosocial support structures.

Urban health and urban health equity

Physical, mental and social health outcomes are linked, and can influence the very determinants of health through positive or negative feedback. For example, poor housing conditions are associated with an increased risk of infectious and chronic respiratory conditions. Urban health and urban health equity have been [globally recognised](#) as crucial issues for the global south. Furthermore, we need to understand



the impact on, and consequences of, the urbanisation process on the multidimensional determinants of health in order to intervene effectively.

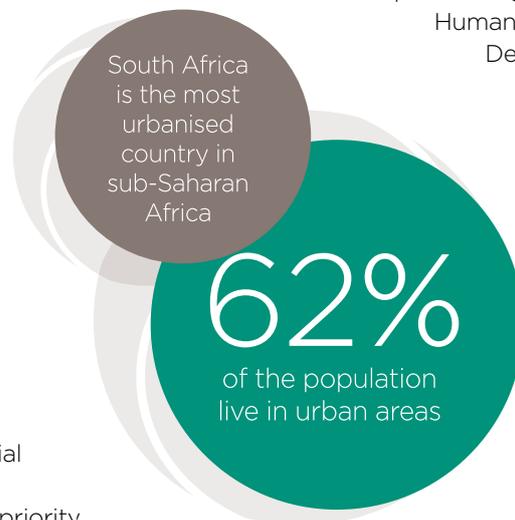
The UN sustainable development goal (SDG) 3 aims to ensure healthy lives and promote well-being for all at all ages. While this is the only explicit health goal, almost all of the other goals relate or contribute to health. This includes the targets of fostering healthier cities (SDG 11) and preventing disease through safe water and sanitation (SDG 6). This recognises that the health sector is but one player in health and human development; action that involves a number of sectors and takes into account the needs of the whole of society is therefore a key strategy to addressing societal challenges that will improve health and well-being.

South Africa is the most urbanised country in sub-Saharan Africa, with 62% of the population living in urban areas. Urban areas are characterised by significant spatial inequities, in which wealthy urban populations have better access to health services on average, and are associated with better health indicators overall; while in the poorer, more informal areas we see the co-existence of chronic communicable and non-communicable diseases, and the paradox of a high prevalence of obesity in communities that are most food insecure.

Nine health goals

The National Development Plan 2030 identifies nine health goals for South Africa, including raising life expectancy to 70 years, reducing maternal, infant and child mortality, and significantly reducing non-communicable diseases (NCD), injuries and violence. Addressing the social determinants of health and disease is identified as a key priority required to achieve these goals.

These goals and priorities were taken into account in the development of the South African Department of Health Strategic Plan 2014 to 2019; one of the key strategic goals is to prevent and reduce the burden of disease and to promote health. Although many of these factors lie outside the expertise and reach of the health sector, it is clear that they interrelate to health and well-being, and signal the need to build health into all policies when addressing societal challenges to improve health and well-being.



Despite the pressing need for this approach, urban health and urban health equity have not yet emerged as major research and policy priorities in South Africa. This represents a major gap, given South Africa's high and complex burden of disease, and high levels of health inequity. In response to this gap, I established the Research Initiative for Cities Health and Equity (RICHE), an interdisciplinary collaboration of UCT researchers from public health; anthropology; civil engineering; architecture, planning and geomatics; human biology; psychiatry and mental health; medicine; pathology; and paediatrics.

The aims of RICHE include generating African perspectives on urban health and urban health equity, and identifying potential areas of research collaboration across disciplines, and opportunities for joint supervision of interdisciplinary postgraduate students.

Intersectoral collaboration

A workshop to tackle the urban health research agenda in August 2015 was attended by 40 RICHE members with extensive global and local urban health experience, resulting in the publication of a [paper](#) on urban health research priorities in Africa. Another notable achievement was the organising of a Health in All Policies workshop to bring together researchers and senior representatives from the Western Cape provincial government departments of Health, Human Settlements, Environmental Affairs and Development Planning, Transport and Public Works, and the Department of the Premier.

The purpose of this workshop was to identify joint priority areas across these sectors that impact on health, and potential opportunities for intersectoral collaboration to co-develop a research agenda, as well as to inform the application of a health lens across non-health sectors in the development of policy. This workshop resulted in the development of research between RICHE and the departments of Human Settlements and Health.

For academia to contribute significantly to achieving the health-related SDGs, there is a need to re-think our approach to conducting research with a focus of collaboration across disciplinary lines, closing the gap between science and policymakers, with a focus on co-production of knowledge, and the training of a new hybrid of students. This change may be slow and sometimes painful, but the potential to contribute meaningfully to improving population health equitably will make it worthwhile in the long run. 

Dr Tolullah Oni is a senior lecturer in the division of Public Health Medicine.

Mental health and the SDGs: building sustainable human capability

Mental health was invisible in the millennium development goals (MDGs). While several researchers have argued that almost all of the MDGs were affected by mental health, and that it would be difficult to attain many of them without addressing mental health, there was no explicit mention of the term. Searching for 'mental' in the MDGs yields words such as 'developmental' and 'environmental', but no 'mental health'!

This was a missed opportunity, because there is now substantial evidence from low- and middle-income countries (LMIC) that women and men who live in poverty and adversity have increased risk for a range of mental health conditions, including depression, anxiety disorders, trauma and schizophrenia.

Conversely, people who live with mental health problems are at greater risk of drifting into or remaining in poverty; because their condition excludes them from income-generating activities, they are frequently stigmatised and subjected to human rights abuses, and they spend more on healthcare than people who do not have mental health problems. So

the relationship between poverty and mental illness is cyclical, including 'social causation' and 'social drift' pathways.

Encouragingly, there is emerging evidence for how this cycle can be broken. In 2011 we published a systematic review in the *Lancet*, which assessed the evidence for the impact of poverty-alleviation interventions on mental health, and the impact of mental-health interventions on poverty in LMIC. We found that the evidence for the former (such as cash transfers and loans) was mixed, and quite thin. But the evidence for the latter, while still nascent, was quite compelling.



Evidence-based mental-health interventions, such as psychological therapies, psychotropic medications and psychosocial rehabilitation programmes in community settings not only led to clinical and functioning improvements, but also improved the economic circumstances of the individuals concerned. In some cases, the benefits extended to their households.

'No health without mental health'

This evidence has emerged as part of a growing field of global mental-health research, led by innovators such as Vikram Patel from India, Ricardo Araya from Chile, and Martin Prince and Graham Thornicroft from the UK. Among other things, this field has improved the cultural relevance of mental-health assessment instruments, developed innovative psychological therapies in low-resource primary-care settings, and improved our understanding of the links between mental health and other physical health conditions, under the slogan 'no health without mental health'.

Armed with this new evidence, a group of global mental-health advocates (including 65 national and international organisations) led by the Centre for Global Mental Health responded to the call for contributions to the new SDGs. Under the banner of 'FundaMentalSDG', this group campaigned tirelessly to have mental health included in the SDGs, presenting arguments that included human rights, healthcare and economic outcomes. Despite initial setbacks, the campaign was eventually successful, and important commitments to mental health were made.

Specific mental health targets

Among them, the SDGs state that mental health must be included in universal health coverage, and that "... we are committed to the prevention and treatment of non-communicable diseases, including behavioural, developmental, and neurological disorders, which constitute a major challenge for sustainable development". In addition, mental health was included in SDG 3 (the health goal), with three specific targets:

- By 2030, reduce by a third premature mortality from non-communicable diseases through prevention and treatment, and promote mental health and well-being (target 3.4);

- Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol (target 3.5); and
- Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services, and access to safe, effective, quality and affordable essential medicines and vaccines for all (target 3.8).

In addition, there has been a commitment to track suicide rates for all countries.

New set of challenges

This is a major victory for the field, and for the millions of marginalised people who live with mental-health problems, particularly vulnerable populations who live in circumstances of poverty. But of course, these new commitments bring a new set of challenges.

Firstly, there are new national and international policy challenges, to invest in and scale up evidence-based mental-health care, and to address the social determinants of mental health: poverty, violence (particularly gender-based violence), inequality and environmental destruction.

Secondly, there are exciting new research challenges: to understand more about the mechanisms of poverty and mental illness cycles in LMIC; specifically, where and when targeted population-based interventions can be delivered that address the mechanisms of poverty and mental illness.

This requires a change of thinking: joining the dots, to integrate mental-health outcomes into the evaluation of violence reduction and poverty-alleviation interventions, and to evaluate the economic and violence-reduction impacts of mental-health interventions.

We are currently engaged in some of these new challenges through research that we conduct from UCT, including the Programme for Improving Mental healthcare (PRIME), the Africa Focus on Intervention Research for Mental health (AFFIRM) and Emerging mental health systems in low and middle-income countries (EMERALD). 

Professor Crick Lund is director of the Alan J Flisher Centre for Public Mental Health, Department of Psychiatry and Mental Health. Image by Halden Krog.



Cancer care meets big data: SA's latest treatment breakthrough

Two South African chemists have made a breakthrough in cancer research that paves the way for early diagnosis and specialised treatment based on each cancer's unique genetic expression pattern.

Early diagnosis is critical for cancer survival; and the discovery made by Dr Kevin Naidoo, DST/NRF SARCH Chair in Scientific Computing in the Department of Chemistry at UCT and Dr Jahanshah Ashkani, also of the department, could therefore have a major impact on the prognosis for cancer patients.

The study, published in the latest issue of *Scientific Reports*, focused on six common cancer types – breast, colon, lung, kidney, ovarian and brain – and found that each of these has a unique genetic expression pattern that can be used for accurate early diagnosis; and more specifically, for specialised treatment.

Naidoo and Ashkani used statistical classification algorithms on large volumes of tumour gene-expression data. By analysing these vast quantities of data, they found that the GT-expression pattern – or the way in which complex carbohydrates are built – can be used to classify different cancer types early on. Moreover, the expression patterns are specific enough that variations can be identified within each cancer type, which can then guide the treatment route.

“The most immediate application of our finding is that we can detect the specific subtypes of a cancer type; and we have shown this for breast cancer,” says Naidoo. “For example, we found distinct patterns for aggressive types of breast cancer, such as what’s commonly termed ‘triple-negative’ breast cancer.”

This application is crucial. Just as early diagnosis has a strong influence on the patient’s prognosis, so too does the choice of treatment. While older cancer treatments

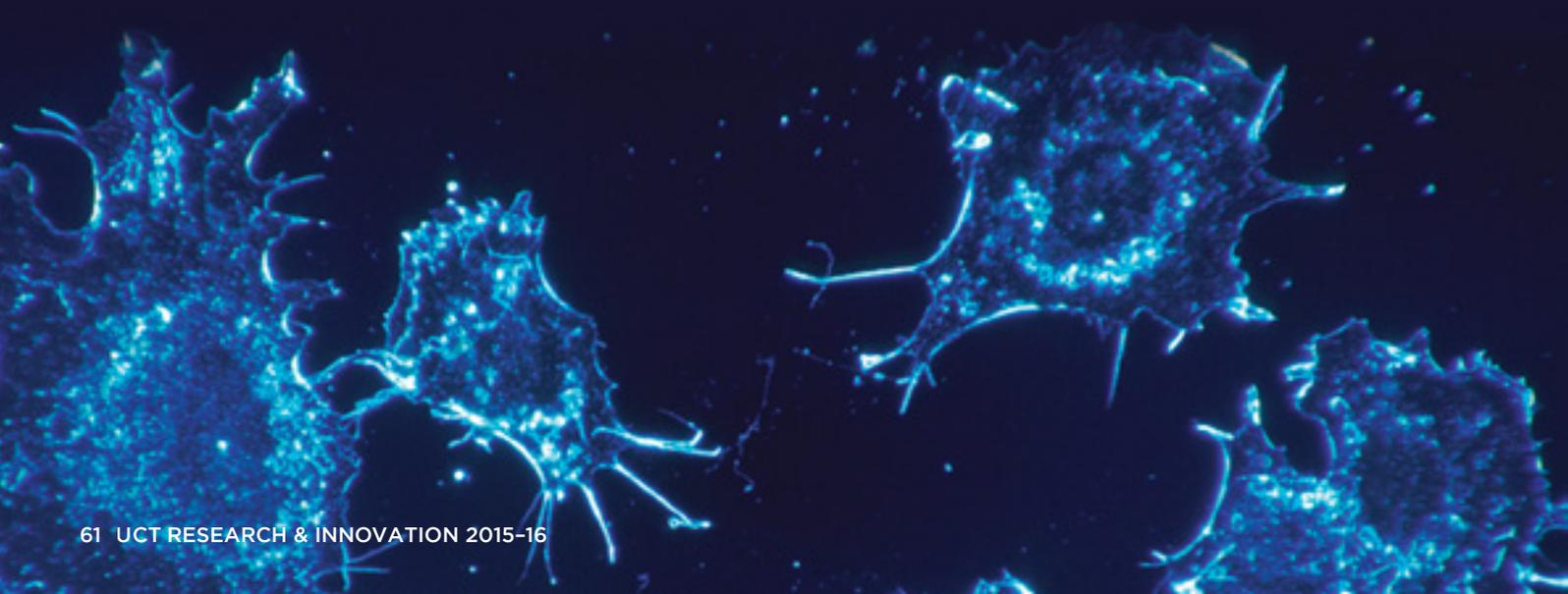
typically killed cancer cells, newer, targeted therapies – which may form part of the treatment regimen, rather than being used in isolation – prevent the proliferation of the cells.

Naidoo and Ashkani’s discovery underlines the importance of using computational big data analytics in biomedical sciences and the developing field of personalised medicine.

“We hope that the field of computational data analytics in biomedicine is able to integrate fully into clinical research in South Africa, as is the world trend,” says Naidoo. “We hope that our research results inspire this structural change in clinical research in South Africa, and that it will lead to the growth and development of ‘precision medicine’ that is being shown worldwide to result in improved patient care and greater survival times in cancer.”

Naidoo is now leading a multi-laboratory collaboration, which will include scientists in pathology and human genetics at the UCT medical campus and the Centre for Proteomics and Genomics Research, to analyse the blood samples of South African patients. The aim is to develop a low-cost gene-expression tool for breast cancer – the most common cancer affecting South African women – which can form the basis of a routinely-used early-diagnostic process. ●

Story adapted from article by Marelise van der Merwe, *Daily Maverick*. Image of cancer cells by the National Cancer Institute, [Wikimedia Commons](#).



10 years on, SA children continue to experience high levels of violence

A look back at the past ten annual issues of the *South African Child Gauge* has revealed both the progress made for South African children, and the obstacles they still face.

In November 2016, UCT's Children's Institute will release the 11th issue of the *South African Child Gauge*: the only publication to provide an annual snapshot on the situation of South Africa's children.

The Children's Institute has outlined massive challenges facing children today. For example, levels of violence against children are excessive: South Africa's child homicide rate is more than double the global average, and most forms of violence are perpetrated by someone known to the child. At the same time, the institute says it is clear that an array of progressive laws and policies have translated into significant gains for children:

Gains for children in South Africa today

- Child poverty dropped from 74% in 2003 to 54% in 2013, driven primarily by the expansion of the Child Support Grant, which now reaches just under 12 million children.
- Children's access to formal housing has increased to 75%, with access to basic sanitation at 72%.
- Deaths of children under five years old have fallen, following the roll-out of the Prevention of Mother to Child Transmission programme.
- Access to early childhood development programmes increased from 55% in 2002 to 91% in 2013, and access to basic education is nearly universal, at 98%.

Challenges facing children today

- Poor-quality schooling acts as a poverty trap, starting in the foundation phase and culminating in high levels of high-school drop-out.

- Just over one million learners started grade 1 in 2003, yet only 49% made it to matric in 2014; and only 8% qualified for a university exemption
- According to the Children's Institute's Children Count project, children remain disproportionately affected by child poverty. Over half of children live in households with a per capita monthly income of less than R671.
- One in five children live in overcrowded households, one in three are without water on site, and one in four are without basic sanitation.
- Nearly half of child homicides take place in the context of child abuse and neglect; and of these, 75% of victims are children under the age of five – where most violence is inflicted at home by a person known to the child.

"Although the South African constitution provides children with the right to be free from maltreatment, abuse and neglect, children continue to experience high levels of violence across multiple settings," said Shanaaz Matthews, director of the Children's Institute.

"Experiences of violence have long-lasting negative effects on the health, social and psychological well-being of a child. It is therefore imperative that we find innovative ways to protect children from violence, and to build children's resilience so they are able to recover from negative experiences. In addition, it is vital that projects such as the *Child Gauge* continue to monitor the status of children, identifying critical gaps and opportunities to strengthen policy and programmes." 

UCT Children's Institute media release. Image by DLR German Aerospace Center, Flickr.

How neurosurgeons can now look at your brain – through your eyes

For many years, scientists have been trying to find a way to measure the pressure in a patient's brain without having to drill a hole in the person's skull. Although this remains the most reliable way to measure pressure in the brain, it is invasive, expensive, and comes with the risk of infection and bleeding.

Assessing pressure inside the brain is an important part of diagnosing certain neurosurgical conditions. These include brain tumours, cranial deformities, traumatic brain injury, and infection.

Several years ago, ultrasound imaging technology – which uses an ultrasound probe, over the eye – was introduced as a non-invasive method to identify this pressure, using static imaging. Although it allows neurosurgeons to assess most cases of pressure inside the brain, static ultrasound imaging does not pick up all cases.

Our study has advanced the current static imaging method. Our technique involves analysing a short video clip of the back of the eye to mark pressure in the brain. It is a faster and potentially more accurate process than the existing technique.

There are limited statistics about children with neurosurgical disorders in Africa, but the number of children with hydrocephalus is thought to be quite high. Hydrocephalus is the result of a build-up of fluid pressure, which compresses the brain and causes the skull to enlarge. Untreated, it can result in death. A reliable technique to estimate the pressure on the brain, therefore, needs to be very accurate.

Dr Llewellyn Padayachy.

Using sound waves to see the brain

The eye is directly linked to the brain by the optic nerve, which sits at the back of the eyeball. It delivers the visual information collected by the retina to the brain. The optic nerve sheath is a balloon-shaped structure. As pressure in the brain builds up, fluid from the brain is forced along this sheath. It dilates the sheath in the same way that a balloon is inflated.

The optic pathway therefore allows us to extract important information from the brain using non-invasive imaging techniques. Recent advances in ultrasound imaging technology have made it a very appealing tool for assessing raised pressure inside the skull. The use of ultrasound in neurosurgery is most appealing, because it is radiation-free, portable, widely available and relatively cheap.

The way the technique works is that the ultrasound probe is placed over the closed eye, allowing us to see the deeper optic structures as they connect with the brain. The currently used technique requires a snapshot to be taken of the optic nerve sheath. The width of the sheath is then compared to other clinical and imaging markers, to infer whether or not there is increased pressure in the brain.

How the new technique works

Our study employed several differences from the existing static imaging technique. Aside from measuring the changes in the diameter of the sheath as an indication of increased pressure, we have developed a dynamic technique that analyses the way the sheath moves as a result of the person's pulse. This motion is then compared with intracranial pressure, and demonstrates a remarkable consistency.

As an initial study, we performed the ultrasound measurement on a large cohort of children. Previous studies using the ultrasound technique on children have not compared it to directly measured pressure in the brain. Diagnosing neurological disease in children is notoriously difficult, because the symptoms are often quite subtle. We also identified certain shortcomings in the current 'static imaging' technique, which resulted in limited accuracy – a limitation described in many other studies.

In a resource-challenged environment such as South Africa, where the average child with a neurological condition is referred to the appropriate centre much later than they should be, an accurate tool that allows early diagnosis would make a substantial difference.

The static technique takes two to three minutes to collect all the images that are needed; our technique could significantly decrease the time required to record the information, to around 30 seconds. It is also the first study of its kind to be conducted on such a large group of patients, with significant results.

The use of non-invasive techniques to measure the pressure inside the brain in order to diagnose certain neurological conditions has attracted much attention recently. These techniques include measurement of blood flow to the brain, and the pressure in the ear. But many of these studies have been limited, because of inconsistent accuracy.

[Watch video here](#)

Making the technique more accessible

Our goal is to refine the accuracy and improve the simplicity of our technique. If we are successful, we hope that assessing the pressure inside the skull using this modified technique may be performed at primary healthcare level. This would speed up the diagnosis of raised pressure in the brain associated with certain neurological disorders.

In a resource-challenged environment, such as South Africa, where the average child with a neurological condition is referred to the appropriate centre much later than they should be, an accurate tool that allows early diagnosis would make a substantial difference.

From a neurosurgical perspective, diagnosing increased pressure in the brain earlier would be a useful marker of underlying neurological disease. This simplified yet effective technique has the potential to change the way we diagnose certain neurological conditions. But more importantly, perhaps, this could be done at the level of primary healthcare facilities, such as day hospitals and clinics. 

This study is a collaboration between UCT's Division of Neurosurgery and a leading Norwegian research institute. It has received a provisional patent. By Dr Llewellyn Padayachy, paediatric neurosurgeon, Department of Surgery, Faculty of Health Sciences. This article first appeared in [The Conversation](#). Image by Michael Hammond.

Listen to Dr Llewellyn Padayachy describe his research on the US public radio daily programme [The Academic Minute](#).

Natural curiosity drives biomedical innovator

Biomedical engineer and winner of a 2016 Claude Leon Merit Award for early-career researchers, Dr Sudesh Sivarasu, draws inspiration from nature to design his patented medical devices. He spoke to Helen Swingler about his work.



What attracted you to biomedical engineering?

As a child in Vellore, India, I was fascinated by steam engines. My father was a train driver, so I got plenty of opportunity to see how they operate. After a terrible road accident, I missed a wonderful opportunity to do business studies in the UK. But this was a blessing in disguise. I did a postgrad degree in biomedical engineering. It was during my postgrad studies that I began to appreciate human anatomy and its design; the body is the most amazing, complex, interconnected and efficient machine. It led to further reading and understanding.

Your academic career began in India and was cemented in South Africa?

Yes. I studied electronics and instrumentation engineering – the equivalent of mechatronics – at the Vellore Institute of Technology (VIT). Both electrical and mechanical engineering design skills are essential to medical device design. After completing my PhD, I was at a crossroads: a lucrative corporate career or a career in academic research? At 26, I chose academia. As a young academic at VIT, I designed their undergrad and postgrad programmes in biomedical engineering. These are some of the most popular biomedical programmes in India. But I wanted to explore scenarios in global health. So, after a brief tenure at VIT, I got a lecturership in the Department of Human Biology at UCT in 2011. Here, I've had a wonderful opportunity to set up clinician discussion platforms and explore the possibility of establishing an appropriate model for medical device innovation.

How does the Claude Leon Merit Award support your research?

It will be used for clinical trials and potential commercialisation of UCT-patented technology that underpins the novel Laxmeter device. This was recently granted patents in the US, UK and South Africa. The device helps measure laxity [or looseness] in all four major knee joint ligaments at various levels of flexion and at full extension. Ligamentous laxity is characterised by loose ligaments, which causes joint hypermobility and joint instability. Sports injuries often compromise ligamentous laxity. The capacity to measure multi-ligamentous laxity makes the Laxmeter unique.

Is this kind of recognition important to an early career academic?

It is essential. Nothing motivates you better than recognition for your hard work.

Tell me about the Frugal Biodesign Process you conceptualised.

It's a unique approach to medical device design and it is suited specifically to developing countries. I've incorporated this process into my medical device design course. Thus far, we've invented several medical devices and some are in clinical trials.

What floats your boat as a researcher?

Trusting that the work that I do will make a difference in someone's life. I want to serve humanity through my work.

By Helen Swingler. Image by Michael Hammond.



Quality education

SDG 4: Ensure inclusive and quality education for all and promote lifelong learning

Improving schools to improve life chances

Despite significant advances in education provision in South Africa since its transition to democracy in 1994, the educational possibilities for South African students, especially in high-poverty areas, remain bleak. While there may be improved access to education, deep inequalities remain with regard to the quality of educational provision; and ultimately, to the educational achievement of the majority of South Africa's school-going youth.

"Our trouble is not that South African children don't go to school," says Dr Jonathan Clark, director of the Schools Development Unit and the Schools Improvement Initiative (SII). "The trouble is that what they learn there does not improve their life chances." There is global acknowledgement that a university's destiny is inextricably linked to that of its community. This acknowledgement is very much the driving force behind the SII. While there are a number of school-development initiatives and programmes across the university, the SII is unique in that it functions as a conduit to help facilitate and draw on the university's broader focus on schooling, which it channels into its partner schools.

How SII works

The SII, established by Vice-Chancellor Dr Max Price in 2012, has become a global trailblazer with respect to school-university partnerships. Making full use of the resources the university has to offer,

the SII is collaborating with disciplines in the health sciences, speech and language therapy, library and, information studies and social development to develop a more holistic approach to school development, and to work with those schools in the context of their communities.

"The SII was always intended to be an action-based initiative, but that does not mean it is not research-informed and does not involve research activities," says Clark.

The SII formed close partnerships with five schools in the Cape Town township of Khayelitsha. These schools were chosen through a careful selection process based on a number of factors, including evidence of improved learner performance, and levels of involvement in teacher development and school-management improvement. In those partnerships, the SII set about achieving a number of objectives. Clark and his colleague and project manager Dr Patti Silbert stress that the objectives of the SII's engagement were



developed in partnership with the schools themselves. They include, among other initiatives, teacher and school organisational development, equipping learners with the skills they need for tertiary education through the 100UP project, and the development of professional-practice schools in which university students and researchers use the schools for their professional training. The professional-practice schools are linked, with the objective of broader institutional engagement. It is through the building of professional-practice schools that the SII collaborates with other disciplines and faculties, to draw on the broader institutional resources in order to enrich the school-university partnership.

Unique interdisciplinary model

For both Clark and Silbert, the interdisciplinarity of the SII model is uniquely significant. Being able to access and use the range of professional capital a university has to offer allows the SII to harness expertise into the partner schools (including all 20 secondary schools in Khayelitsha) in a way that is focused on the schools' needs. The collaborating faculties also gain from their involvement in the initiative, in that the exposure allows them to generate new practices that are more appropriate and applicable to the community context than if they were doing their traditional discipline-specific practice.

For students registered for the Bachelor of Social Work, the SII provides a great opportunity to complete their compulsory field practice. The fieldwork in the schools has also been fertile ground for postgraduates to develop research questions. But importantly, notes Fatima Williams (a lecturer in the Department of Social Development), the provision of social work services in the schools means that all areas of learners' lives receive attention, not just their educational needs.

"The reality of learners is that they are severely impacted by any psychosocial issues, and do not attend school in a vacuum," says Williams. "The social work services offered by the students help the learners not only emotionally, but with their performance at school, too."

In the Faculty of Health Sciences there has been a strong focus on interdisciplinarity between occupational therapy, speech therapy and education students. For Roshan Galvaan, associate professor in the Division of Occupational Therapy, this collaboration has created a space for researchers to consider complex issues beyond disciplinary boundaries.

For all researchers and students participating in the school-university partnership, the community



context is valuable. Students in the Division of Communication Sciences and Disorders – which includes speech language therapy students and audiology students – are developing new approaches to practice within a community development framework.

Student support strategies

"The students work with the school and community to develop strategies to support and strengthen language-literacy learning, which the school identified as an area of need," says Professor Harsha Kathard of the Department of Health Sciences Education. In her opinion, this opportunity allows the students and researchers to develop collaborative interdisciplinary practices that result in creative, sustainable and responsive practice innovations.

An important part of the SII model for school-university partnership is the focus on reciprocity: both partners benefit from the experience. The schools themselves are actively involved in identifying their own needs.

"The most exciting thing for me about this initiative is how we can be the agents of change in difficult situations. It is a great feeling working with principals who leverage their relationship with us to access the resources and support they know their school needs," says Clark. ○

By Natalie Simon. Images by the Schools Improvement Initiative.



Higher education must change students' agency in the world

"Higher education must change the person, and it must change their capacity to act in the world; what they can do, and how they do it," says Professor Jenni Case, who is based at the Centre for Research in Engineering and Science Education. Her book, *Researching Student Learning in Higher Education: a social realist approach*, won UCT's Meritorious Book Award for 2015.

Change and agency are at the heart of the work, which leaps beyond conventional educational theory and tackles crucial aspects of students' access and success in higher education. Case began her research in the early 2000s, when

she spent a year in class with third-year chemical engineering students at UCT. Her interviews gave her a real sense of their alienation from the higher education system – and how it sometimes fails them.

"There's an assumption that if we 'fix' the first-year transition, everything will be okay," says Case. "But third-year engineering is really tough. The students are already dealing with their evolution as 20-year-olds, living with the multiple legacies of apartheid, dislocated from their home backgrounds, and trying to cope with one of the university's toughest courses – with frighteningly little margin for error."

Based on a story by Helen Swingler. Image by Michael Hammond.

Crisis in education in West Africa must be addressed

It is widely recognised that job creation is a crucial aspect of development, and that broad-based, high-quality education is a valuable input for pro-poor development. Unfortunately, in many West African countries, the majority of the population still cannot read or write, or do simple mathematics. Worryingly low levels of educational quantity (how many children are able to go to school), as well as educational quality (how many of the children who are in school acquire basic literacy and numeracy skills), indicate that there is a crisis of education.

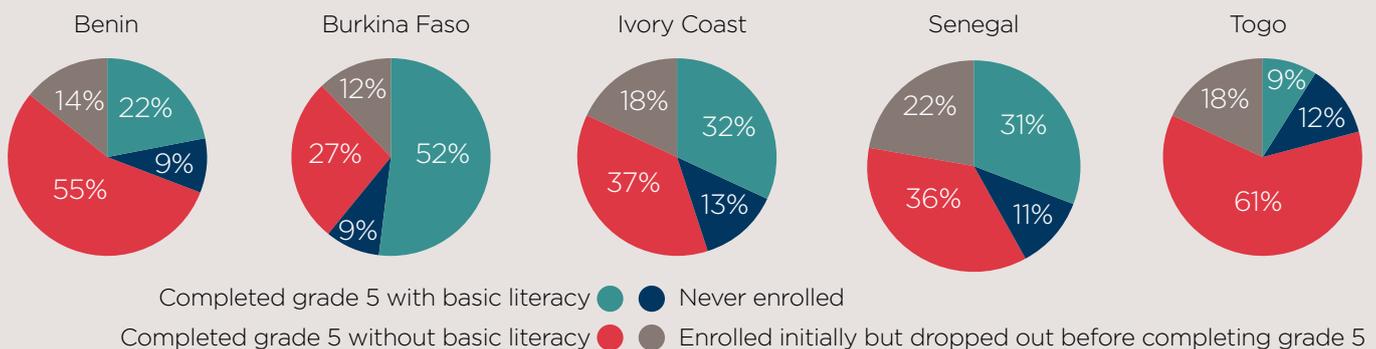
"This must be attended to if growth, and inclusive growth, are to pull people out of poverty and into the labour market at a sufficient rate," says Adaiah Lilenstein of the [Development Policy Research Unit](#). Her research is based on five West African countries (Benin, Burkina Faso, Ivory Coast, Senegal and Togo). Her findings are based on the Grade 5 regional assessment programme for West Africa, called PASEC. The results show that the rate for access to literacy and numeracy (i.e. the proportion of the population that both go to school and acquire basic literacy and numeracy skills at a Grade 5 level) was under 50% for all participating countries, and between 10% and 20% for most. The pattern of access and quality issues

differed between countries. "However, all countries still had disastrously high levels of the three indicators – non-enrolment, drop-out, and lack of learning within school," says Lilenstein.

"With such low rates of literacy and numeracy, how can these countries be expected to create valuable employment for all their citizens?" Lilenstein asks. Getting education right is a crucial first step in the road to eradicating unemployment and poverty, and must be considered a priority by national governments and donors alike.

The full article was published by the World Bank's Jobs and Development Blog.

Grade 5 access, literacy and access to literacy rates





Gender equality

SDG 5: Achieve gender equality and empower all women and girls
life-long learning



Image by Lindsay Mgbor for Department for International Development, Flickr.



Sufi Narratives of Intimacy

The year 1994 was particularly memorable for Muslim South Africans because of two significant events. First, the first non-racial democratic elections took place, signalling the official death of apartheid. Second, Professor Amina Wadud, a visiting scholar and author of a pioneering Islamic feminist work, *Qur'an and Woman*, delivered the Friday sermon (khuṭba) at the Claremont Main Road Mosque, which I attended.

The mosque had invited Wadud to share her insights on Islam with its members, who also decided to use the occasion to transform the gendered nature of their prayer space. Not only was a woman going

to give the all-important Friday sermon, but the female congregants would move from the balcony into the central space of the masjid, on par with, albeit separate from, the men.

For me, a young committed Muslim woman, entering the newly open and receptive masjid felt like stepping into the warmth of the sunshine after a lifetime of being concealed in the shadows, a feeling somewhat akin to voting in my country of birth for the first time. In my experiential framework, this minority congregation was boldly embodying a fundamental social justice imperative that was intrinsic to Islam. However, even as this act of liberation unfolded, many broader community contestations of this event were pervaded by assumptions that women are somehow peculiarly and inferiorly defined by their bodies and that these female bodies, in the proximity of men, somehow diminish and threaten the sacredness of the mosque. Integrating justice and harmony into both personal and communal religious spaces constitutes a serious religious challenge for a number of contemporary Muslims, which is why women's free access to central spaces of worship and women's ritual leadership remain controversial topics.

Wadud's khuṭba at the Claremont Main Road mosque was inspirational. Her words were like a glorious, warm summer rain, drenching us in mercy and radiating all kinds of existential possibilities. This was a spiritually ripe sermon, inspired and inspiring, beautiful and beautifying, luminous and illuminating. She went to the very heart of the matter, to the understanding of Islam as a state of engaged surrender in all of our most intimate and immediate relationships as human beings – marriage, pregnancy, childbirth – and sites of intimate relationship to the divine One.

For the first time in my adult life in a public religious space, I felt myself sincerely validated as a Muslim



woman. While some sectors of the South African Muslim community enthusiastically hailed the event, other segments of that community became incensed. The resulting conflict reflected fierce struggles regarding Muslim understandings of sexuality, sacrality, and human embodiment.

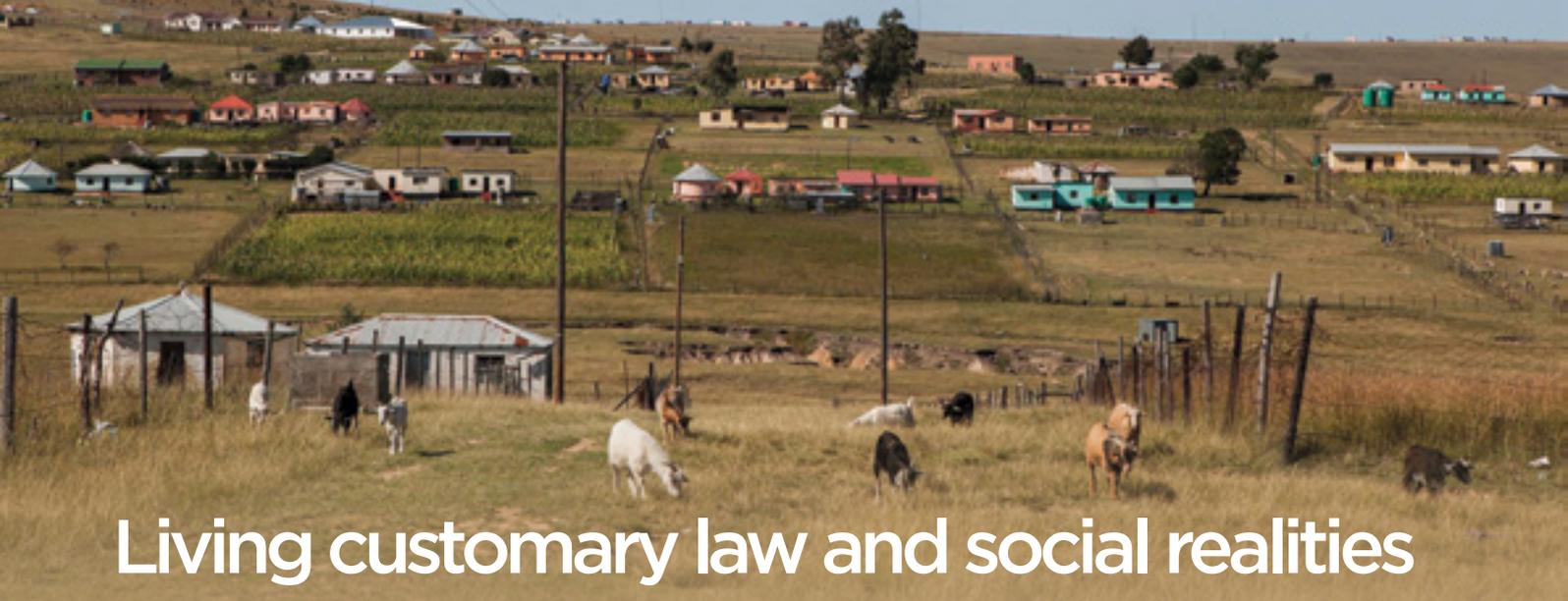
Contemporary gender politics relating to Islam is not restricted to the issue of women imams or internal differences within the Muslim world. Wide-ranging geopolitical dynamics and ideological contestations are played out on the bodies of Muslim women. Representations of Muslim women vacillate between dominant Western images of Muslim women as oppressed, and apologist Islamist images of Muslim women as the only truly liberated women.

The debates on both sides are often simplistic, rigidly formulated, authoritarian, ideologically loaded, and contingent on the political forces of the day. Examples abound. French public schools prohibit Muslim women from wearing head scarves (ḥijāb), ostensibly as a marker of a secular society; conversely, postrevolutionary Iran imposes the ḥijāb as a symbol of authentic Islamic identity. US politicians strategically invoked the plight of Afghani women as a way to build public support for the American-led invasion of Afghanistan in 2001, yet are notably silent about the Saudi regime's appalling women's rights record as a result of the two countries' intimate political-economic relationship. In many parts of the Muslim world, notions of gender equality are often interwoven with larger postcolonial identity struggles about indigenous values, cultural allegiances, and loyalties and disloyalties.

The global context for discussions of gender justice and Islam is, therefore, ideologically fraught with contestations of the nature of religion, law and secularism; citizenship, identity and empire; freedom, equality and self-expression. Many antagonists in these debates share the assumption that Islam is a monolithic religion with a singular, all-embracing gender paradigm. Such generalisations not only belie the complex varying realities of contemporary Muslim women, but also ignore the rich diversity of the Islamic tradition that is informed by the mélange of Arab, Turkic, Persian, Andalusian, African, and South Asian histories and cultures.

Gender dynamics among Muslims are as complex and polymorphous as the realities of women (and even men, for that matter) in other religious, social and political contexts. While there are undoubtedly universal aspects within Islam that fall within a cohesive religious category, this unity is mostly accompanied by myriad diversities. ○

Excerpt from Sufi Narratives of Intimacy by Associate Professor Sa'diyya Shaikh. The book, published by University of North Carolina Press, won the UCT Book Award in 2015. Image of Sa'diyya Shaikh by Michael Hammond.



Living customary law and social realities

Under apartheid, most married women in South Africa were regarded in law as minors, under the guardianship of their male relatives or husbands. New laws since 1994 set out to change that. But are the new laws working?

Professor Chuma Himonga, the DST/NRF SARCH Chair in Customary Law, Indigenous Values and Human Rights, and Dr Elena Moore of the Department of Sociology, conducted a national study, in collaboration with the National Movement of Rural Women, to examine how the new laws operate in practice. They found that structural and cultural barriers make these laws very difficult to implement.

Before 1994, the law barely recognised customary marriages, as opposed to marriages entered into in accordance with the Marriage Act 25 of 1961. Women in customary marriages were regarded as perpetual minors; they could not acquire or own property in their own right. In some parts of the country, husbands in a customary marriage had absolute ownership of household property and the personal property (including earnings) of their wives.

In the post-apartheid era, the Recognition of Customary Marriage Act (RCMA) improved women's access to economic resources from a marriage. The new laws introduced principles of gender equality, non-discrimination, and the protection of the rights of children in the family. All children, including female children and children born outside the marriage, now have an equal right to inherit. However, many women are still not benefiting from these new laws.

The findings of Himonga and Moore's study highlight the uneven consequences of divorce and intestate succession for many black South African women as wives, daughters or sisters. Failure to register a customary marriage has race and gender consequences that cannot be overlooked.

While almost one in every two men and women in a civil marriage is employed, only two in every five men and women in a customary marriage are employed. Only one-quarter of women in customary marriages are employed, compared to 37.5% of women in civil marriages. Among black South Africans there are almost five times as many widows as widowers, and there are almost twice as many separated or divorced women as men.

Customary vs civil marriage

A customary marriage and a civil marriage are both types of legal marriage. Either can be registered at the Department of Home Affairs. Whereas a civil marriage is contracted between two parties under the Marriage Act, a customary marriage is legally defined as a marriage in accordance with customary law: that is, the customs and usages that are traditionally observed among the indigenous African peoples of South Africa and which form part of the culture of those peoples. People can register their marriage according to customary law or civil law, but not both.

Himonga and Moore's study revealed a great deal of confusion among married couples about the differences between customary and civil marriages, and about the registration process and the legal regulation of both types of marriage. Despite the introduction of the Recognition of Customary Marriage Act, civil marriages are thought to provide better legal protection. According to Himonga and Moore, this is not the case.

Moreover, registering a marriage with the Department of Home Affairs was strongly associated with civil marriages: almost all the participants in Himonga and Moore's study thought they had registered their marriages as customary marriages; but in fact, they were all married under the Marriage Act. They were unaware of the marital system they had married under, and they were therefore unaware of the rights and responsibilities of being married according to a specific legal system.

The findings also show that officers registering marriages did not distinguish between registering a customary marriage and registering a civil marriage. This raises the question of whether officials at the Department of Home Affairs are prioritising the registration of civil marriages at the expense of customary marriage registrations.

The question of lobolo

There is much discussion about the requirements for a valid customary marriage, but Himonga and Moore's findings show that the practices of the courts and the practices of the people require the payment of lobolo and the integration of the wife into the husband's family for the conclusion of a valid marriage. In some cases, part or full payment of lobolo is a prerequisite for concluding a valid marriage, while in others, the agreement to pay is sufficient.

Take the following example from the findings: Frank married Asanda (not their real names) in 1978; Asanda changed her surname, lived with her husband and his family, and participated in family life. Frank passed away in 2002, and Asanda sought to obtain the spousal benefit from her husband's pension, while continuing to live in the marital home. Frank's family said that she was never married, as Frank had died before he had finished paying lobolo. Asanda could not prove she was married to Frank, as the couple had not registered the marriage.

It has been suggested that people dispute the validity of a marriage as a way of escaping the financial obligations to spouses at the end of marriage. When this happens, the dispute hinges on the terms under which lobolo was negotiated. One side will argue that full payment was required, while the other side will argue that the families regarded the wife as a spouse. In most cases, there is no proof that a valid marriage exists, as the couple did not register their marriage. Providing evidence of a valid marriage is then very difficult, especially when elders have passed away.

The transfer of lobolo and the registration of a marriage are intricately linked in the eyes of the participants. However, the authors argue that for the purposes of the requirements for a valid marriage, the marriage should come into existence when the lobolo agreement is concluded, not when it is actually paid; especially since the parties behave as though they are married after the

agreement. This also ensures that the woman acquires a legally protected status earlier rather than later.

These matters affect the everyday lives of many South Africans, and their access to the resources necessary to sustain their livelihoods. People in customary marriages represent some of the most marginalised and vulnerable people in our society.

New laws fail to ensure equality: women still excluded from inheritance

As part of the drive to transform customary family relations in post-apartheid South Africa, in line with the new constitutional rights and principles outlawing discrimination, the Constitutional Court decision in *Bhe v Magistrate Khayelitsha* abolished the rule of male primogeniture. This was because it was discriminatory against women and children born outside marriage, contrary to constitutional principles. Instead, the court created new rules of inheritance. For instance, if the deceased is survived by one spouse, the spouse inherits the entire estate. Where the deceased is not survived by a spouse or spouses, but descendants (children), the descendants – including extra-marital children – inherit the entire estate.

But despite these new rules, some members of the deceased's family who should inherit, still do not do so. For example, some daughters, widows and extra-marital children are excluded from the estate of a deceased family head. There are several reasons for this, one of which is the fact that many estates are administered and distributed informally, within the family. In other words, they are not administered and distributed by the Master of the Court's office. In the study, in some cases, this was because interested parties were not aware of the new rules.

In other cases, participants said they did not like or approve of the new rules, because they did not include the customary-law idea of family property. According to customary law, family property belongs to the deceased's family. At death, the property is not inherited, but given to a 'custodian' heir who holds it for the entire family of the deceased (the extended family), for their common use and support in time of need.

Since the objectives of the new rules are not being met in practice, there is a need for measures to improve the implementation of the new rules, to realise the objective of eradicating discrimination in inheritance procedure against women and children born outside marriage. ○

This feature is based on a series of articles published in www.groundup.org.za. More insights from this study can be found in the authors' book, Reform of Customary Marriage, Divorce and Succession in South Africa: living customary law and social realities. Image by Salym Fayad, Flickr.



Access to healthcare for women

The culture of illegal abortion in South Africa

In 1996, the South African Choice on Termination of Pregnancy (CTOP) Act was passed, promoting the right to safe and legal abortion. Even though abortion is now freely accessible under South African law, many thousands of women continue to terminate unwanted pregnancies illegally every year.

Medical historian, Dr Rebecca Hodes, at the AIDS and Society Research Unit in the Centre for Social Science Research, investigated why the rates of illegal abortion remain persistently high, despite the mandates of reproductive health legislation.

While the law reflects the state's commitment to reproductive rights, the stigma and suffering that often accompany abortion reveal a chasm between policy objectives and their real-world enactment in South Africa's public health sector. Clinical observations and expert interviews revealed

that pain and humiliation among abortion patients may be accepted as an inevitable part of its public provision. The participants in her research describe how pain blockers are given infrequently to abortion patients.

One healthcare worker, with decades of experience in treating medical abortion patients, explained: "The woman don't get pain medication. They abort at home, they abort on the way [to hospital], or they abort while waiting there." While some healthcare workers sought to adapt national health protocols to

improve the patient experience, "shortages in equipment to ensure the quality of care rendered the experience of abortion more painful and more difficult for many women in this study," says Hodes.

"The law mandates that abortion should be a safe medical procedure that forms an integral part of healthcare in South Africa. Nevertheless, through obstructing its access and rendering its legal procurement a conduit of punishment and suffering, it remains a source of pain, enacted against the women whose health it is meant to protect," says Hodes.

Novel use of mobile technology helps women self-assess their eligibility for early medical abortion

New research suggests that women could use their cell phones to accurately assess their eligibility for medical abortion, via an online gestational-age calculator called *i-calculate*.

Most pregnancy-calculator applications or websites use due-date calculators, and provide other information that is not suitable for a woman seeking to terminate a pregnancy. This mobile app represents an opportunity to empower women, by providing them with self-assessment opportunities and accurate and safe abortion information.

The director of the Women's Health Research Unit (WHRU), Associate Professor Jane Harries, led the IPAS-funded pilot study to explore women's experience of using the *i-calculate* app. Once they had accessed the site, women were guided through a process

that included determining the first day of their last menstrual period, as well as five standardised medical abortion-eligibility questions. After completing the online process, they received confirmation messages of their self-calculated gestational age. Most of the participants found the online gestational calculator easy to use.

"Seeking services earlier in pregnancy is safer, less expensive, and provides more options for women," says Harries. The ability to self-assess gestational age using an online calculator has the potential to empower women, providing them with some self-autonomy of health care.

As part of a multi-country Global Turnaway Study, the Women's Health Research Unit (WHRU) partnered with researchers at the University of California, San Francisco to find out what happens when women are denied access to legal abortion services in South Africa. A high proportion of women who were initially denied an abortion at legal facilities went on to seek options for pregnancy termination outside the legal system, through internet searches – some of which could have led to unsafe abortion practices. "Further efforts should be directed towards informing women about the availability of free services in the public sector, and educating them about the dangers of unsafe methods of pregnancy termination," says WHRU director Associate Professor Jane Harries.

Cheaper HPV vaccine might come from tobacco

In a pioneering step towards using plants to produce vaccines against cervical cancer and other viruses, UCT researchers have generated synthetic human papillomavirus-derived viral particles called pseudovirions in tobacco plants.

Biopharming uses plants as 'biological factories'. They have been used to create flu vaccines, potential anti-Ebola drugs, and an enzyme used to treat Gaucher's disease in people. Now, researchers from the Biopharming Research Unit (BPRU) report using tobacco plants to create synthetic viral particles known as pseudovirions. These pseudovirions look like viral infections, but contain no infectious viral DNA.

The shell of this newly-created pseudovirion was of the human papillomavirus (HPV) type 16, which is responsible for more than 50% of cervical cancer

cases worldwide. This is the first time researchers have successfully created pseudovirions in plants – up to now, yeast and mammalian cell cultures have been the glass ceiling. The BRU team hope this new plant-based technology could one day be used to test future HPV vaccines.

Image by Magnus Manske, [Wikimedia Commons](#).



Lack of rehabilitation for women after breast cancer surgery impacts their ability to work

While improved cancer treatment protocols lead to higher survival rates and reduced side effects, many women develop upper limb pain, dysfunction and swelling for up to six years post-surgery – all of which impact on the patient's quality of life and their ability to return to work.

To better understand the impact of this pain and dysfunction in South Africa, Dr Delva Shamley, director of the Clinical Research Centre, led a prevalence study involving over 300 patients. Shamley's study showed that even up to two years post-treatment, 78% of the participants were unemployed; 41% had a swollen arm; 48% reported pain associated with shoulder movement at a level shown to interfere with the activities of daily living; and 43% scored

greater than 40 for disability (out of a maximum of 80).

Despite these findings, current access to rehabilitation services is patchy to non-existent. That this aspect of care does not fall into the standard cancer-care pathway means that patients remain uneducated and unmanaged with respect to the long-term impact of treatment.

In the absence of comprehensive social support in South Africa,

most women cannot afford not to work after receiving breast cancer treatment. In order to enable women to re-enter the workforce after receiving treatment, "a public-health intervention for breast cancer-related lymphoedema and upper limb pain and dysfunction is crucial," says Shamley. Her team continues to work towards developing a suitable intervention that will be delivered at all levels of care.

Mainstreaming a gender perspective is crucial

The sustainable development framework emanating from the United Nation's (UN) 2030 **Agenda for Sustainable Development** acknowledges that the achievement of sustainable development must include 'a world in which every woman and girl enjoys full gender equality'. In addition to a stand-alone goal (SDG 5) to achieve gender equality and empower all women and girls, the systematic mainstreaming of a gender perspective in the implementation of all other goals is crucial, argues **Rashida Manjoo**.

The expansive and aspirational provisions of SDG 5 include the following targets: ending all forms of discrimination against women and girls everywhere; eliminating all forms of violence in both public and private spheres; the recognition and valuing of unpaid care and domestic work; ensuring women's full and effective participation and equal opportunities for leadership at all levels; and ensuring universal access to sexual and reproductive health rights.

The means of achieving the targets include undertaking reforms to give women equal rights to economic resources in accordance with national laws, and the adoption and strengthening of policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls.

Fundamental human rights

These laudable goals and targets are underpinned by the fundamental human-rights obligations of states to respect, protect, promote and fulfil all human rights and fundamental freedoms of women and girls. This requires political will and an adequate allocation of resources to address inequality, discrimination, disempowerment and violence. In order to effectively implement SDG 5, states should act in good faith and commit the same effort and resources to achieving SDG 5 as they do to the other goals.

Women's rights activists remain concerned about the barriers to full and effective implementation of all goals, due to the inclusion of language such as: 'as reflected in UN policy documents' (which are not legally binding on states), 'taking into account national circumstances' and 'in accordance with national laws'. The concern

is that the pledge 'that no one will be left behind' will not necessarily be applicable when addressing the individual, institutional, structural and multifaceted needs of women and girls.

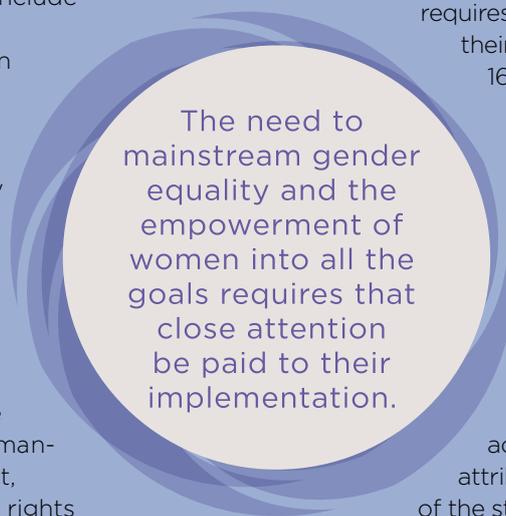
Accountable and inclusive institutions

The need to mainstream gender equality and the empowerment of women into all the goals requires that close attention be paid to their implementation. This includes SDG 16, which requires the promotion of peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and the building of effective, accountable and inclusive institutions at all levels.

It is important to bear in mind that state responsibility for violations of human rights may be based on acts or omissions committed by state actors or by those whose actions are attributable to the state, or by a failure of the state to act to prevent or respond to violations perpetrated by non-state actors.

Thus, the monitoring of state responsibility in their efforts to implement the SDGs requires vigilance, to ensure that they are observing the frameworks through which obligations and accountability emanate. This, in turn, requires a robust and transparent review process for the SDGs.

Rashida Manjoo is a professor in the Department of Public Law. She is the former UN special rapporteur on violence against women, its causes and consequences, a post she held from 2009 to 2015.



The need to mainstream gender equality and the empowerment of women into all the goals requires that close attention be paid to their implementation.



Clean water and sanitation

SDG 6: Ensure access to water and sanitation for all



Image by World Bank, Flickr.

Water is high on UCT's research agenda

Removing pollution from water and turning waste into value

Research based on work done by Professor Alison Lewis and her team in the Crystallisation and Precipitation Unit (CPU), is being used at Eskom's R8.3 million pilot eutectic freeze crystallisation plant. The research, funded by Eskom, removes all pollution from the water, solidifies it into pure salts and cleans the water so it can be reused in the power plant.

Using a technique called **eutectic freeze crystallisation**, Lewis and her team, Hilton Heydenrych, Benita Aspeling, Jemittias Chivavava and Genevieve Harding, have pioneered a way of turning contaminated mine water into clean potable water and individual salts.

This involves freezing out fresh water from the hyper-saline brine that makes up acid mine drainage, before separating out the individual salts by freezing them at individual

(eutectic) temperatures. It produces hardly any toxic waste. The outcome is water clean enough to return to the environment, and salts (such as gypsum, used in building) that can be recycled. "Acid mine drainage is talked about as toxic waste, but it's 98% water. It's about turning waste into value," says Lewis. She claims that 99.9% of polluted water can be reused.

Lewis received a prestigious Water Research Commission

(WRC) award in the category of New Products and Services for Economic Development. "It is very exciting to see our years of research being put to use. Last year, Eskom consumed 298 billion litres of water; the plant will allow it to improve its consumption of fresh water, and to start using polluted mine water. It's cost-effective and environmentally friendly."

Based on a story by Andrea Weiss.

Young researcher develops cost-effective solution for treating municipal wastewater

Wastewater management is integral to access to clean water and sanitation, and in preventing pollution. Increasing levels of sewer pollution require sustainable wastewater treatment solutions.

Dr David Ikumi is committed to tackling this challenge. "The struggle for a clean, ample supply of water for sustaining life continuously intensifies; there is a necessity for effective conservation, management and distribution of our water resources," he says.

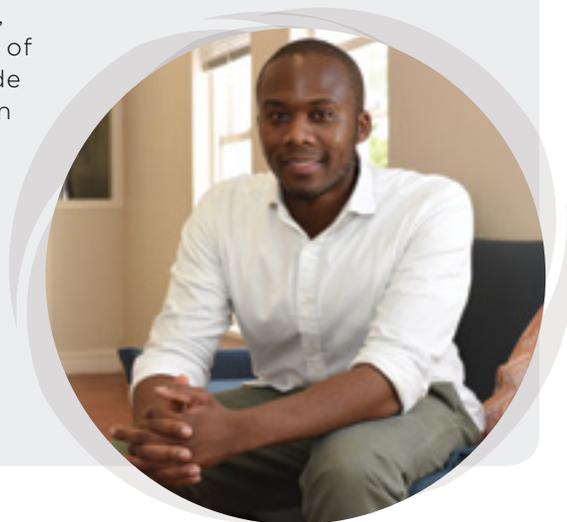
Ikumi's research focuses on the mathematical modelling of wastewater treatment systems, in particular, bioprocess modelling, based on the recurrent behaviour of microorganisms that mediate wastewater treatment in various environments. This involves attempting to virtually replicate behavioural patterns in the development of mathematical models. "It's similar to assembling pieces of a puzzle," says Ikumi.

Biodegradability defines the extent to which organics that enter unit operations of the wastewater treatment plant can be broken down. In a unit process, the unbiodegradable particulate organics usually become enmeshed with the rest of the sludge mass. The remaining biodegradable particulate organics, when broken down anaerobically, provide energy in the form of methane and carbon dioxide production. The models can aid the design of ideal treatment systems and may optimise operations.

Under the leadership of Professor George Ekama, the Water Research Group has been developing mathematical models

and wastewater treatment system configurations that are used internationally. "We are continuously asking ourselves exactly what the wastewater treatment systems of the future should look like", says Ikumi.

Based on a story by Chido Mbambe. Photo Michael Hammond.



Future Water

Early in 2016, UCT announced the establishment of the Future Water research institute, which seeks to develop new approaches to the ways in which water is managed, thus meeting the challenges of water scarcity and ensuring equal access to this precious resource.

Future Water is a transdisciplinary research institute, under the directorship of Professor Sue Harrison from the Department of Chemical Engineering.

It integrates the work of researchers across 10 departments and five faculties. Research addresses water scarcity within an overarching systems framework that includes the effective integration of urban design, planning and

management, in order to facilitate a change in urban areas from 'water-wasteful' to 'water-sensitive'. Supported by strong sociological, technical, environmental, legislative and governance expertise, it aims to understand different perspectives of water use in both urban and rural settings, and focuses on providing for people, industry and the environment.

In particular, the Institute addresses the government's

development-oriented goals and the need for efficient resource use, social equity and poverty alleviation, focusing on 'new' water resources, water-sensitive management, maximising value from minimum resource, and building resilience and strengthening governance.

The goal is to recognise resource scarcity, but ensure that all people have access to water of sufficient quality.

Novel use of cell-phone technology to help rural communities with water management

In 2015, Information for Community Services (iCOMMS), an interdisciplinary research group, received an award from the Water Research Commission (WRC) of South Africa for its novel use of information communication technologies (ICT) to help rural communities and municipalities to improve water service delivery. Founder and team leader, Professor Ulrike Rivett, says: "We started off by developing mobile applications for water quality management, which were implemented in Asia and Africa. Today we are able to understand ICT and its potential in far more detail." Some of the projects undertaken by iCOMMS in the past year include:

World Bank Study

iCOMMS partnered with management consulting firm Cowater International in a World Bank project: a study in seven African countries to build knowledge and develop guidelines for the use of ICT tools and services. It investigated the emerging uses of ICT across sectors in order to improve the planning, implementation, monitoring, management and regulation of and accountability for water and sanitation systems.

DropDrop

iCOMMS developed an Android phone application, DropDrop, to help individuals track their water consumption. The app allows users to access information on their daily water usage, predicted end-month water bills, water conservation methods, municipal contacts and the water system. The application does not require internet access to function, making it useful in communities with limited or no internet access. The iCOMMS team collaborated with the City of Cape Town municipality to assess the impact of Drop Drop on water demand management and water conservation at household level.

Eastern Cape Research

In collaboration with the Nelson Mandela Metropolitan University, iCOMMS conducted a study for the WRC in the Cacadu District of the Eastern Cape, to empower communities by investigating if and how ICTs can give them a voice in local governance. It contributed towards understanding how to engage rural communities as key stakeholders in water supply management, and provided scientific evidence for the use and usefulness of ICTs in rural community engagement in the water, sanitation and hygiene (WaSH) sector. By developing an ICT tool that can be used anonymously to report problems, the research left communities feeling more empowered to raise concerns and report faults in water supply.

Based on a story by Carolyn McGibbon.



Will SDG 6 improve access to water and sanitation?

Access to water and sanitation was one of the targets under Millennium Development Goal (MDG) 7, on environmental sustainability. By the end of 2015 we had seen mixed results. The target of halving the proportion of people without access to improved sources of water was met five years ahead of schedule, but – according to the United Nations (UN) – 2.4 billion people globally still lack access to basic sanitation. Loretta Feris argues that SDG6 has the potential not only to increase the number of people who have access, but to make it more equitable.

During the period of the MDGs, a UN General Assembly resolution recognised human rights to water and sanitation; which was followed by an affirmation by the Human Rights Council (HRC) that the rights to water and sanitation derive from the right to life and the right to human dignity, as well as “from the right to an adequate standard of living and ... the right to the highest attainable standard of physical and mental health.” This creates clear and substantive obligations on states to respect and promote the right to sanitation. Having made these strides, the question arises whether the SDG on water and sanitation, SDG 6, will advance the gains made so far.

We have seen some significant differences between the MDGs and SDG 6 that provide grounds for optimism. Under the MDGs, the water and sanitation target was framed rather simplistically: to “halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation”. The target did not require an assessment of which sectors of a population would gain access. Furthermore, the MDGs focused mainly on poverty and health: environmental concerns were underemphasised.

It is clear that issues of universality, equality, vulnerability and the environment have been taken into account in the targets set under SDG 6, and the adoption of a human right influenced its framing. Specific targets include the need to achieve universal, equitable access to safe and affordable drinking water; and to provide access to adequate, equitable sanitation and hygiene, with special attention to those in vulnerable situations. The inclusion of the need to strengthen the participation of local communities will

strengthen targets related to universal access. It also includes targets related to integrated water-resource management, water quality, the protection and restoration of water-related ecosystems, and increased water-use efficiency to address availability of water – in particular, water scarcity.

“The SDGs shift the responsibility from developing countries to all states; it is a global responsibility that needs to be taken up by both state and non-state-actors.”

More than a numbers game

What are the implications of this framing? It requires that states and non-state actors engage with both the human-rights and environmental dimensions of SDG 6. Meeting the target becomes more than a numbers game; and states must consider not only how many, but who will gain access to water and sanitation.

It also requires that states ensure the protection of water, and of all aquatic ecosystems that are used in sanitation or act as receptors for sewage systems; incentivise the quest for alternatives to waterborne sanitation; and stimulate much-needed research on the suitability of more sustainable sanitation solutions.

Finally, the SDGs shift the responsibility from developing countries to all states; it is a global responsibility that needs to be taken up by both state and non-state actors. Funding for meeting SDG 6 will have to come not only from states, but also from development banks, national development agencies, donor funding and the private sector. ●

Loretta Feris is a professor of law and director of the Institute of Marine and Environment Law. Image by Pixabay.



Affordable, clean energy and climate action

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all

SDG 13: Take urgent action to combat climate change and its impacts



Image by Warrenski, Flickr.

African development in a changing climate

The fossil-fuelled energy systems that fired the industrialisation of the western economies of Europe, North America, the USSR, and more recently the emerging economies have had a range of positive socioeconomic development outcomes. But these economic growth spurs came with environmental and (ultimately) social costs that are increasingly being felt, and will grow for many decades into the future. Climate change is one of the most high-profile examples of unsustainable development, write Mark New, Gina Ziervogel and Britta Rennkamp.

Adaptation to climate change

Building a climate-adapted society makes good development sense. Many of the most vulnerable in Africa are caught in poverty traps that are reinforced by climatic impacts. For example, droughts and floods cause damage to farms and property; and households spend years recovering, only to be knocked back by the next drought or flood.

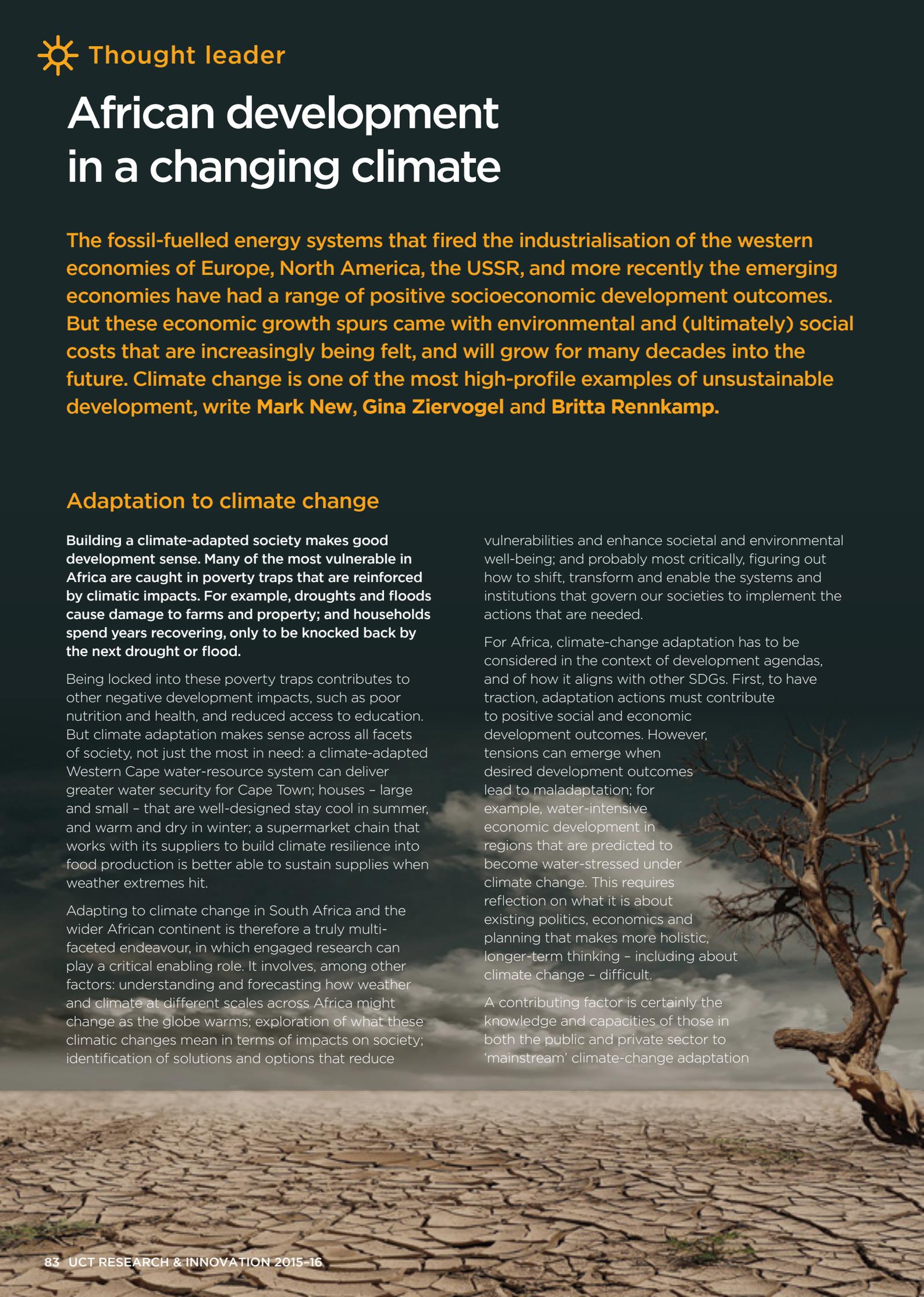
Being locked into these poverty traps contributes to other negative development impacts, such as poor nutrition and health, and reduced access to education. But climate adaptation makes sense across all facets of society, not just the most in need: a climate-adapted Western Cape water-resource system can deliver greater water security for Cape Town; houses – large and small – that are well-designed stay cool in summer, and warm and dry in winter; a supermarket chain that works with its suppliers to build climate resilience into food production is better able to sustain supplies when weather extremes hit.

Adapting to climate change in South Africa and the wider African continent is therefore a truly multi-faceted endeavour, in which engaged research can play a critical enabling role. It involves, among other factors: understanding and forecasting how weather and climate at different scales across Africa might change as the globe warms; exploration of what these climatic changes mean in terms of impacts on society; identification of solutions and options that reduce

vulnerabilities and enhance societal and environmental well-being; and probably most critically, figuring out how to shift, transform and enable the systems and institutions that govern our societies to implement the actions that are needed.

For Africa, climate-change adaptation has to be considered in the context of development agendas, and of how it aligns with other SDGs. First, to have traction, adaptation actions must contribute to positive social and economic development outcomes. However, tensions can emerge when desired development outcomes lead to maladaptation; for example, water-intensive economic development in regions that are predicted to become water-stressed under climate change. This requires reflection on what it is about existing politics, economics and planning that makes more holistic, longer-term thinking – including about climate change – difficult.

A contributing factor is certainly the knowledge and capacities of those in both the public and private sector to ‘mainstream’ climate-change adaptation



into their everyday practice and policy; universities such as UCT have a responsibility to develop curricula and professional courses that help build this capacity.

Second, and more critically, we have to question whether a climate-adapted society is achievable in the face of today's structural development issues. Can we expect government – on a national or local scale – to effectively support adaptation when many government entities are poorly governed and poorly resourced, both financially and in terms of human capacity? Can we expect those most vulnerable to climate change to prioritise climate adaptation when their day-to-day life faces much more urgent stressors, such as conflict, corruption and lack of basic infrastructure? Adapting to climate change –

while challenging – also offers levers to address some of these structural development barriers, by ensuring that wherever possible, adaptation is transformative: by changing the structures within which adaptation occurs, and the agency of those individuals and organisations at the front line of the response. 

By Professor Mark New, pro-vice-chancellor for climate change and director of the African Climate and Development Initiative (ACDI), and Associate Professor Gina Ziervogel, a lecturer in the Department of Environmental and Geographical Science, and research chair in the ACDI.

Mitigation of climate change and poverty reduction: trade-offs or win-win?

Combating human-induced climate change is not a challenge that exists in isolation. Developing countries, especially on the African continent, still struggle with income and energy poverty. Poverty reduction and provision of universal access to energy typically produce increases in greenhouse-gas emissions. Developmental pathways that reach prosperity without associated emissions increases are possible, but remain scarce in practice. Increases in the consumption, production and reserves of known fossil fuels on the African continent raise further concerns about their impact on our climate.

Despite these trends, climate-change issues in Africa continue to fall mainly into the category of adaptation. 'Adaptation' carves out a political space within the international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), which historically has made industrialised countries responsible for 'mitigation' to reduce emissions urgently. The convention establishes that climate-change responses must take "into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty".

The past decade showed changes in human and economic development that challenge the historical division of responsibilities in climate-change response. The majority of the world's poor no longer live in the least developed countries, but in middle-income countries. On the African continent, 23 countries have reached middle-income status, according to World Bank data.

Reaching middle-income status is obviously not a goal on its own. Economic growth, growing transport and energy use produce emissions that add to the problem of global climate change. A solution based on the assumption of global inequality in emissions may not hold in future. In middle-income countries, the urgency to address rising emissions, while reducing poverty and advancing economically, increasingly becomes a domestic-policy problem.

Research performed in a project on climate-change mitigation and poverty reduction has shown that the assumptions of trade-offs between measures for emissions and poverty reduction do not necessarily hold in domestic policy processes. The main barriers to implementation of measures for emissions reduction emerge from the distributional conflicts. The assumption of trade-offs between emissions and poverty reduction continues to dominate the discourse in international negotiations.

Comparative research on climate governance in three fossil-fuelled middle-income countries has shown that renewable energy programmes can successfully be implemented without international support for development or climate finance.

Distributional conflicts between the coalitions between beneficiaries and potential losers of climate policies are the main obstacles to extracting these win-win situations. Governments tend to prioritise socioeconomic development measures over climate policies. Researchers have focused on the questions of how to combine these measures and produce so-called 'co-benefits' for climate from conventional development policies, and vice versa. There has also been a special focus on the combating of energy poverty explicitly through the provision of access for productive use in informal enterprises, as well as on clean cooking technologies in low-income households in Southern Africa.

Future research will aim to expand the agenda on the question of how to achieve high prosperity in low-emissions development pathways further into the African continent. 

By Dr Britta Rennkamp, a researcher in the Energy, Environment and Climate Change Group at the Energy Research Centre, and senior fellow at the ACDI. Feature image by Pixabay.

How climate change is causing pied crow numbers to soar

Pied crows, or *Corvus albus*, are a natural part of the landscape of southern Africa. They are bold, common and familiar. But there has been evidence over recent years, especially in South Africa, that there are many more of these birds than there used to be.

The increase is worrying some conservationists, who fear it could be having a negative impact on local biodiversity. These fears have some merit, given that the species is known to predate on birds' nests and young tortoises. Farmers are also concerned about the potential damage to sheep flocks, because crows pluck out the eyes of young lambs.

The effect of changes in temperature

Research confirms that there has been an increase in pied crows in South Africa, and quite dramatic changes in their centre of abundance. These changes vary throughout the country, with large increases in the south-west, but declines in the north and east of the country.

In addition, our results suggest that these changes are closely linked to climate change.

Using data from two bird atlases carried out 20 years apart, and linking these changes with information on the changing climate, we found that pied crows have increased mainly in the geographic areas of South Africa known as the Karoo and fynbos shrublands which are distinctive types of vegetation of south-western South Africa. This is where temperatures are increasing. These biomes are relatively arid habitats consisting principally of short shrubs, with very few natural trees.

The decline in numbers in the north-west of the country is most probably related to climate cooling in this region. It appears that the crows are following a warming climate bubble into the south-west. Our research suggests pied crows have a preferred temperature range roughly equal to an average annual temperature of 19°C. We are approaching this in the south-west of South Africa at the moment, and the crows are loving it.



Our results also suggest that this shift has been aided by the presence of power-line infrastructure. This has provided sites for crows to build their nests in what is otherwise a virtually treeless landscape.

We conclude that while power lines have facilitated the increase of pied crows in the Karoo, climate change has driven their soaring numbers in these areas. The combination of climate change and electrical infrastructure has created the ‘perfect storm’ of conditions to favour an explosion of pied crow numbers in the shrublands of South Africa.

An unloved species

Crows are big and obvious. Pied crows, in particular, are easy to identify, with their white tank-top plumage. These birds have had a bad rap globally. This dates back to medieval times, when they were reviled as carrion birds on battlefields; and large, black birds are superstitiously associated with ill omens or death.

Their collective noun – a murder of crows – doesn’t exactly do much for their public image either. Given all this history, it is perhaps understandable that people react emotionally when they see crows doing what crows do best: being predators.

In South Africa, pied crows are notorious, and viewed with great suspicion by urbanites and rural farmers alike. They are accused of such gory deeds as plucking the eyes from newborn lambs, destroying the eggs of ground-nesting birds and decimating populations of tortoises.

They’re also vilified for harassing other much more glamorous species, notably Verreaux’s eagles. Indeed, these perceptions have led to calls for the control of pied crows by those who are worried about their negative impacts.

But these observations are not sufficient evidence to suggest that crows have an overwhelming negative impact on ecosystems. A recent scientific review suggests that in general, they don’t.

The truth is that their role within ecosystems is not necessarily that straightforward. For example, they also eat other predators, such as small snakes, which can be a major cause of nest failure in Karoo birds. Thus, increased numbers of pied crows certainly have the potential to change the balance of predator-prey interactions.

Given the situation, it may be that pied crows are an example of the relatively new phenomenon of the native invader. These are species that occur naturally in one area, but whose numbers suddenly increase out of all proportion with their surrounding ecosystems, shifting the balance of nature in unpredictable ways.

For a species to be considered a native invader in the truest sense, it needs to have a demonstrably negative



impact on other species. But while the pied crow clearly has such potential, we do not yet have the evidence to confirm they are causing declines of other species. Therefore, in assessing the pied crow ‘problem’, we must be careful not to jump to conclusions.

Climate change is ongoing

Throughout the world, animals and plants are responding to the changing climate by shifting their ranges, changing their behaviour, and changing their abundance.

But climate change is ongoing, so these shifts may continue to change over time. It is likely that we are not stepping into a new stable state, but rather witnessing one step in a continual transition, as species adjust (or fail to adjust) to conditions that are in a state of flux.

What happens next is uncertain.

As warming continues, will pied crow numbers in the south-west of South Africa subside again? Or will they adapt to their new conditions? Either way, it is still unclear what the legacy of the ‘pied crow invasion’ will be. ○

By Susan Cunningham and Arjun Amar, lecturer and senior lecturer at UCT’s Percy FitzPatrick Institute of African Ornithology. First published in [The Conversation](#). Images by Peter Ryan.

Fracking in the Karoo: pollution versus pay-off

Technological advancements over the past decade have led to a rapid rise in unconventional natural gas production, known as ‘shale gas’, particularly in the USA and Canada. The large-scale and rapid development of shale gas has resulted in an abundant and cheap energy source, with lower direct greenhouse gas (GHG) emissions than coal and petroleum. South Africa has the eighth-largest technically recoverable shale gas reserve in the world, located in three geological formations in the Karoo; surely, then, that should be cause for celebration? But global concerns about the environmental impacts of shale gas development and production on local water supplies, air quality and human health have made the process of extracting this natural gas – called hydraulic fracturing, or ‘fracking’ – a very contentious issue, writes Katye Altieri.

To frack or not to frack?

The economic value of this deposit has been estimated to range from 3.3 to 10.4% of Gross Domestic Product (GDP), while estimates of the number of new jobs that could be created in its extraction varies considerably, from 1 441 to 700 000. The potential impacts on GDP and job creation in South Africa – an upper-middle-income developing country with a 26.7% unemployment rate – are critical factors to consider when weighing up the pros and cons between shale gas development and environmental concerns.

A further consideration is the current power crisis in South Africa, in which the power parastatal Eskom has been unable to provide adequate electricity to match demand. Eskom is in the process of building two new coal-fired power stations, but this development is greatly at odds with South Africa’s commitment to reduce GHG

emissions in the coming years. Currently, natural gas contributes only 2.8% to primary energy in South Africa, and is used primarily to produce synthetic liquid fuels.

The development of shale gas in South Africa could lead to a significant shift in the electricity sector, by replacing coal-fired electricity. In addition, bridging from coal to natural gas could assist in South Africa’s commitment to a peak, plateau and decline GHG emissions trajectory, as gas-fired electricity generation is compatible with energy from renewables in a way that coal and nuclear are not.

Air pollution and GHG trade-offs

However, the GHG-reduction benefits gained from shale gas are not guaranteed; neither does shale gas come without its own set of air pollution costs. Whether the



costs are worth it depends largely on methane leakage rates, strict monitoring and enforcement of best-practice regulations during fracking, and how the gas itself is used. Shale gas exploitation requires new wells to be drilled regularly and operate continuously, which results in 24-hour pollution from diesel generators, stationary engines and truck traffic transporting water and waste to and from the well pads. The main pollutants include nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter (PM). NO_x and VOCs are precursors to ozone, which is linked to asthma, decreased lung function and premature mortality. Increased PM leads to increased hospital admissions, respiratory symptoms, chronic respiratory and cardiovascular diseases, decreased lung function and premature mortality. However, use of shale gas could result in considerable health benefits – despite the air pollution – if its use displaced other, dirtier, fuels such as coal or wood for use indoors in poorer households.

Filling the knowledge gap

The Karoo is a sparsely populated and vast area with low levels of industrial activity. Before shale gas exploration occurs in South Africa, it is important to investigate the potential negative impacts on air quality in the Karoo, as well as the potential benefits for GHG emissions for South Africa as a whole. Policymakers need to formulate an air-quality monitoring plan, and prescribe emissions regulation levels; but currently, they lack the basic information required to begin such an assessment.

A recent study conducted with my colleague, Adrian Stone, and published in the journal *Atmospheric Environment*, seeks to fill this gap in knowledge by developing a prospective air-pollutant emissions inventory for the NO_x, PM and VOCs associated with all aspects of shale gas. Emissions inventories can be used to establish regulations, devise enforcement strategies and health-risk assessments, as a predictive tool to establish monitoring strategies and as inputs to regional air-quality models.

The amount of air pollution that results from shale gas depends on the number of wells drilled, as well as the technology used. We constructed a well-development model for South Africa, using information from existing well fields in the USA and what is known about the scale of the Karoo shale gas field. A wide range of technologies were assumed to be possible, from old engines (e.g. those available from mining operations), which could lead to high pollutant emissions, to newer electric engines, which would minimise air pollutant emissions. All of the uncertainty was included in the emissions calculations, such that a range of emissions is determined – from the best case, of very controlled resource exploitation using clean

technologies, to the worst case, of old polluting technologies and high levels of well development.

Prospective impact of shale gas on air quality

We find that the shale gas industry will probably become the largest regional source of NO_x and VOCs (bearing in mind the current under-development of the region), comparable to adding a city the size of Durban to the middle of the Karoo. Even if the lowest estimate of NO_x emissions is used, shale gas would be the fourth-largest source of NO_x nationally. Similarly, VOCs from shale gas activities would be the second-largest source of VOCs in the country. The high estimated values of NO_x and VOC emissions are a concern, for regional ozone and for compliance with national ambient air-quality standards. But emissions could be reduced, even with large-scale development, using already existing control technologies.

It is important to note that this is a prospective emissions inventory, for activities that have not commenced, and indeed may never happen. Good-practice guidelines will be needed to minimise impacts on air quality and reduce GHG emissions, with guidelines for control technologies, consideration of effective legal regulation, early establishment of baselines, and continuous monitoring and good governance enabled by co-ordination across several South African institutions – a challenging set of tasks. The literature on shale gas development is largely international, particularly from the USA, with relatively few studies undertaken in South Africa. This partly reflects different levels of development of shale gas, but points to the overall need for more research, including on air quality and GHG risks under South African conditions. 

Renewable energy is available as nature provides it, not as a function of electricity demand. Therefore, demand and supply cannot always be matched. Natural gas electricity-generation plants respond to demand very rapidly compared to both coal and nuclear, which provide baseload electricity. Baseload plants can take several days to start up and shut down; and they run all of the time, providing a continuous level of energy. Natural gas peaking plants are smaller and can respond rapidly to changes in supply and demand. Thus, natural gas is quite compatible with renewable energy, as it fills the gaps in supply created by variable wind and sun.

By Dr Katye Altieri, research scientist at the Energy Research Centre. Image by South African Tourism, Flickr.

How one region is planning ahead to help farmers cope with climate change

In South Africa's Western Cape, agriculture plays an important role in the economy, job creation and socioeconomic development. But the sector is particularly vulnerable to a changing climate.

There have thus been calls for urgent action to guide and support the agricultural sector to adapt to the unavoidable impact of climate change, and to reduce its greenhouse gas emissions.

Relevant government departments recognised that a strategic and coordinated approach was needed to develop long-term resilience to climate change. This could be done through climate-smart

agriculture and by placing the sector on a clear pathway towards a green economy.

To do this, the University of Cape Town and two provincial government departments – Agriculture, and Environmental Affairs and Development Planning – collaborated on the Smart Agriculture for Climate Resilience programme. It launched in August 2014.



First of its kind

This is the first provincial climate change policy for agriculture in South Africa. The project specifically focuses on food security and promotes climate-smart agriculture. It also aligns closely with the current five-year provincial strategic plan and the Department of Agriculture's strategic goals. One of the key goals is to optimise the sustainable use of water and land resources to increase climate-smart agricultural production.

The programme is premised on collaborative planning and action within and between the public and private sectors. This includes national, provincial and local government. It also includes organised agriculture and industry associations, farmers, agri-processors and agri-business, labour and civil society, and research and academic institutions. The project has thus far achieved an understanding of expected climate risks and impacts and vulnerabilities in agriculture. It has established the important linkages between resource sectors, water, energy and agricultural production. It also showed that vulnerability is high across the sector.

One of the project's key successes was a framework to battle the harsh impact of climate change. Areas that have a much milder climate and where climate change will not be as dramatic have also been identified. These may become the future centres of food production.

Capacity to adapt

There is existing capacity in the Western Cape's agricultural sector to adapt to the added stresses of climate change. Local companies are already providing energy-saving low-carbon solutions to farms and agri-businesses.

Leading wine estates have installed energy-saving measures and systems for renewable energy generation. The FruitLook project is using satellite images to help fruit farmers increase their irrigation efficiency. These solutions must be harnessed to stimulate innovation and technology transfer for climate-change adaptation and mitigation.

The resilience project hopes to ensure that the existing response capacity is developed to its greatest potential. It promotes responses that are practical, relevant and locally implementable over various timescales and budgets.

The project has taken a strong spatial approach, creating 23 spatial zones. This is because the risks and impacts of climate change will differ widely across the province. It is all dependent on climate, soils, vegetation and farming systems.

Western marginal grain zones such as the 'Rooi Karoo - Aurora' are expected to shift to livestock production. This zone will become hotter and drier. Some zones



could benefit from mild warming and wetting, for example the southern 'GrootBrak-Plett' zone.

The project proposes a focus on four strategic areas with the aim to:

- 1 Promote a climate-resilient low-carbon production system that is productive, competitive, equitable and ecologically sustainable;
- 2 Strengthen effective climate disaster risk-reduction and management for agriculture;
- 3 Strengthen monitoring, data and knowledge management and sharing, and lead strategic research for climate change and agriculture; and
- 4 Ensure good cooperative governance and joint planning for effective climate change response implementation for agriculture.

It is also important that climate-change considerations be integrated into longer-term resource and economic planning. Another round of stakeholder engagements will ensure that the plan is realistic and implementable. The project will be completed during March 2016.

By Stephanie Midgley, a researcher and project manager in agriculture, food security and climate change at the African Climate and Development Initiative (ACDI). Main image by Dave Bezaire, Flickr. This article first appeared in [The Conversation](#). Image above by World Bank, Flickr. 

Fossil fuel interests might derail efforts to stem extreme global warming

The Paris Agreement, adopted by the United Nations in December 2015, aims to keep global warming to below 2°C; but unless countries ramp up their climate-change combating duties, global temperatures could rise by nearly double that by the end of this century.

This is despite agreement by countries to pursue efforts to stem global warming below even 1.5°C, says Professor Harald Winkler, director of the Energy Research Centre. Winkler co-authored a global study that urges governments, the private sector and civil society to increase their efforts to – essentially – save the world. The [study](#) was published on 30 June 2016 in the journal *Nature*.

Before Paris, each country submitted its strategy outlining how it planned to curb the increase in global temperatures and reduce climate change. However, these Intended Nationally Determined Contributions (INDCs) do not add up to the collective temperature goal.

“The centre of the article is an assessment of the effect of these current INDCs on reducing greenhouse gas emissions,” says Winkler.

“But there are many other issues. The article is clear about whether the distribution is fair, and how much adaptation may be needed – adaptation is how we respond to impact. But the focus here is on mitigation.”

In short, if countries continue with half-hearted implementation, we’re on track to seeing global temperatures rise by as much as 3.1°C by 2100. This is a sobering scenario, admits Winkler.

“Essentially what we’re saying is that what’s been committed is great; the Paris Agreement also says more should be done,” says Winkler. “If countries don’t implement INDCs and stronger efforts in future, then we won’t get to the stated goal.”

The little that remains of a global carbon budget that would keep temperature increases well below 2°C might be used up as early as 2030.

Joeri Rogelj, a researcher at the International Institute for Applied Systems Analysis (IIASA), who led the study, says: “The Paris Agreement ... puts in place a flexible framework for a long-term transformation towards a low-carbon society. But our analysis shows that these measures need to be strengthened in order to have a good chance of keeping warming to well below 2°C, let alone 1.5°C.”

Niklas Höhne, a researcher at both the New Climate Institute in Germany and Wageningen University, who also worked on the study, adds that reducing emissions by between 3 and 4 percent globally after 2030 would be needed to realise the Paris Agreement’s goal.

“But in practice, switching to such stringent reductions right after 2030 would be challenging, and would require time – that means that in order to ensure a chance of meeting these targets, we need significant further action from countries before 2030,” says Höhne.

What could happen if we don’t make the 2°C threshold?

There’s a whole body of work dedicated to the impact of climate change, and none of the predictions are comforting.

“The consequences range across everything from sea-level rise to waterborne diseases,” says Winkler. “There are huge impacts on water systems for agriculture, with some areas getting wetter and others getting drier, but generally the predictions for climate change go along the lines of ‘the higher the temperature, the more the risk of negative impact’.”

Do all INDCs aim equally high?

The short answer is, no, they don’t. But sometimes there are good reasons for this. Winkler’s own research focuses on the question of equity, and the fair distribution of climate-change goals.

“Essentially, it’s about political economy,” says Winkler. “Fossil-fuel companies have a vested interest in high emissions. In our country, coal is the issue. We use coal for electricity. And 30% of our liquid fuel comes from coal. In other countries, the high-emissions interests are in the agriculture or forestry industries. Globally, it is the big fossil-fuel companies that need to imagine a very different future.

“So when countries have a national discussion, it’s effectively a national negotiation, asking ‘What can we do?’

There’s a little bit of an effect of saying, well, you know, if we take on a very large effort of reducing greenhouse gas emissions and our competitors don’t, then maybe we’re disadvantaging our economy.

“That may be a valid concern, but you can also make the argument the other way. To be competitive in the future low-carbon society, we should be investing proactively in energy efficiency, renewable energy and all low-carbon technologies right now. But even more fundamentally, we need to have a national conversation about how the structure of our energy economy needs to change. We need to position South Africa to be a leader in some part of the future low-carbon economy. That means taking a long-term perspective on near-term investment decisions. Or more plainly, investing in the future.” Also, says Winkler, some countries may put less lofty goals on the international table; so that if they exceed these more moderate goals, they look good.

“I think it’s fair to say that it’s mainly the fossil-fuel industry that’s holding back greater ambition,” Winkler concludes.



About fossil fuels

Renewable energy has come on in leaps and bounds since Winkler arrived at UCT in 2000.

“From almost nothing, it’s grown really fast. We’re now seeing a lot of renewable energy. Some technologies, notably wind and photovoltaics (PV), are now cheaper than new coal plants. However, other renewable-energy technology, such as concentrating

solar power, is currently not cost-competitive.

“Wind and PV are now cheaper than new coal. That’s an amazing turnaround. When I came to UCT in 2000, coal was considered the cheapest fuel for electricity – even in the world. That was partly because we weren’t paying the carbon cost. Now we’ve passed a tipping point where the cleaner solutions are cheaper. And that’s before the carbon tax has been implemented by treasury – that still needs to happen.”



Was the 2°C goal a compromise figure?

That number has been floating around for a decade or so, explains Winkler. There’s been debate backwards and forwards between scientists and policymakers.

“The IPCC – the Intergovernmental Panel on Climate Change – has done a lot of work on the impacts of a given temperature increase, carefully assessing the probabilities and uncertainties over decades. What is very clear is firstly that climate change is ‘unequivocally’ due to human activity; and secondly that generally, the higher the temperature, the more negative impacts there are. For example, with 4°C, you’ll get more sea-level rise than with 2°C.

“But then the scientists say, ‘We can’t decide. There’s no such thing as a safe limit.’ Science punts us back to the United Nations Framework Convention on Climate Change, which aimed (back in 1992) ‘to prevent dangerous anthropogenic interference with the climate system’.

“What is ‘dangerous’ is a value judgment. What is risk? How many more people who get malaria are you willing to accept? Do you accept five? Do you accept 500 000? 500 million?

“So, responding to climate change is a prime example of the science-policy interface. You need both the best available scientific information and the value judgements made by political systems. ‘Well below 2°C’ is our best effort at putting a number to what is not too dangerous.”

Unfortunately, says Winkler, people may only start acting against climate change once things are tangibly much worse.

Accountability

Since the Paris Agreement, countries must report back on how they have been implementing their INDCs every two years, and they must develop new INDCs every five years, says Winkler.

“Up until Paris, it wasn’t a requirement. Now it’s mandatory.”

Unfortunately, says Winkler, people may only start acting against climate change once things are tangibly much worse.

“If there was more extensive drought and more floods, if it becomes increasingly clear that the climate is changing, then I think people will say, ‘Actually, this problem is real.’”

By Yusuf Omar. Image by [Tony Webster](#) via [Wikimedia Commons](#).



Industry, innovation and infrastructure

SDG 9: Build resilient infrastructure, promote sustainable industrialisation and foster innovation



Innovation, infrastructure and industrialisation: the cornerstones to economic health

The United Nations' 2030 Agenda for Sustainable Development aims to transform our world through a set of 17 goals. Sustainable development goals (SDGs) 8 and 9 could be considered prerequisites – the means, as Adam Szirmai put it, to achieve the other goals. Adequate infrastructure, together with industrialisation (which is an indirect effect of infrastructure) and creativity (innovation), are the cornerstones for economic competitiveness, and therefore closely connected to the achievement of political, social and economic goals. But innovation reaches far beyond these two goals, argues **Piet Barnard**.

The Global Competiveness Report 2015/2016, which provides an overview of the competitiveness performance of 140 economies, ranked South Africa 49th overall, putting the country in the top 35% of all countries. South Africa is ranked 36th on innovation and business sophistication, 50th on technological readiness, 59th on infrastructure (mainly due to a low rating for electricity supply – 116th), 12th on financial-market development and 38th on goods-market efficiency, to name but a few. Based on this, one would consider South Africa to be well positioned in terms of SDG 9, and as a result able to address the other goals.

UCT's Research Strategy 2015 to 2025 commits the institution to contribute, through its research and innovation, to (*inter alia*) the better health of our citizens and those of our continent, the elimination of poverty, and creating the conditions for a meaningful life. The strategy furthermore pledges that the institution "will serve both South Africa and the rest of our continent by contributing to its ability to innovate in a world where new and radical thinking ensures the competitive edge".

Innovation is an integral part of our strategy; as a result, an innovation working group was established to help in building an innovation culture. The working group does not limit innovation to those inventions that lead to patents and the generation of income, but has defined innovation as "the creation and successful implementation of new ideas and inventions that make a real difference through the generation of tangible outcomes with social and/or financial value".

This definition seeks to include the notion of social innovation. The university's research strategy speaks to many of the SDGs, and is addressing those through various initiatives; many of these include significant innovation. For instance, SDG 3 (Good health and well-being), which is a bold commitment to end the epidemics of AIDS, TB, malaria and other communicable diseases, is at the core of the research of the Institute of Infectious Disease and Molecular Medicine (IDM), and UCT holds numerous patents related to these diseases.

However, UCT is not unique in these commitments and initiatives. Many of the other South African universities have similar initiatives, and are also undertaking similar, credible research. The question is then: why does the Global Competitive Report rate South Africa 128th on health and 120th on quality of education? These rankings place South Africa behind neighbouring countries such as Botswana, Zambia and Zimbabwe. What are we doing wrong? What are we as a research community, in collaboration with government and the private sector, going to do to address these problems?

Resolving these two important matters will require innovative thinking, commitment and collaboration. We need to get this right; if we don't, many of the goals – despite our current efforts – will remain just that: goals. ○

Piet Barnard is director of Research, Contacts and Innovation.

Africa's first d-school trains postgrads to solve complex real-world challenges

The newly-established Hasso Plattner Institute of Design thinking (HPI d-school) at UCT is one of only three HPI d-schools in the world. “The school’s overall objective is to promote design thinking as an enabler of innovation and new outcomes that can meet the needs of users in complex socio-political and economic contexts,” says Richard Perez, founding director of the UCT HPI d-school.

Design-thinking training’s basic tenets are collaboration, human-centredness, creative thinking and learning through doing. The d-school’s flagship offering is transdisciplinary training in design-led innovation to postgraduate students registered at any faculty at UCT.

Design-led innovation is seen as both a career and an entrepreneurial competency. “It’s a way of thinking that provides students with tools and a process – and ultimately, a mindset – that equips them to work together to create solutions to real-world challenges,” says Perez.

The focus of the training is experiential learning, and students work in multidisciplinary teams, closely mentored by coaches, in a customised studio space. During the training, students apply design-thinking tools and techniques to develop solutions for real-world challenges provided by strategic project partners.

Among these partners have been one of South Africa’s major financial institutions, a department of a local municipality and a start-up. The partners receive the benefit of user insights, a library of ideas and a tested prototype of one of the ideas.

The HPI d-school at UCT also offers other training programmes, including courses for executives, undergraduates, young entrepreneurs, and organisations and institutions.

The other HPI d-schools are at Stanford University in the USA (est. 2005) and Potsdam University in Germany (est. 2007). The school is supported with funding, IP and academic support by the Hasso Plattner Trust. ○



Powering Africa's first hydrogen fuel-cell aircraft

An award-winning aircraft – a large, fixed-wing, unmanned aerial vehicle (UAV) – has been designed to carry out long-range surveys and environmental research. It will be powered using miniaturised hydrogen fuel cells that were designed, prototyped and trialled by HySA/Catalysis. It is an excellent example of the centre's mission to help transform South Africa's economy into one that manufactures from its wealth of raw materials, rather than just supplying them for others to exploit.



HySA/Catalysis – co-hosted by UCT and Mintek – is one of three government-funded centres of competence, and is tasked with developing South Africa’s contribution to global hydrogen and fuel cell technology. The centre collaborated with Professor Arnaud Malan and his team from the Department of Mechanical Engineering and **FlyH2 Aerospace**, the company that will be producing the UAV, which became a licensee of the patented fuel cell technology developed by HySA/Catalysis.

Speaking after the UAV recently won first prize at the **Avi awards** held by the Council for Scientific and Industrial Research in Pretoria, co-founder of FlyH2 Aerospace Mark van Wyk described the aircraft as the first of its kind to be designed and built in Africa. Better yet, the use of hydrogen fuel cells means that the aircraft will operate with zero emissions. “The system emissions are completely toxicant-free,” van Wyk explains. “In the future, our company wishes to develop the technology further, to a level where it can also power manned aircraft. Both Boeing and Airbus have undertaken significant research into hydrogen fuel cells. This could be the future of green aviation.”

The UAV, however, is just one application of fuel cell technology. When it comes to HySA/Catalysis, the centre’s aims are far broader. Dr Sharon Blair, director of HySA/Catalysis, explains that the centre hopes to assist in transforming South Africa’s economy from a resource-based economy – as a supplier of raw materials – to a knowledge-based economy, developing, manufacturing and exporting value-added products. Right now, South Africa sells platinum as a raw metal, and exports it,” explains Blair. “Other countries then upgrade that platinum to create products that we buy back – at a much higher price.” Her goal, at HySA/Catalysis, is to make sure South Africa develops the manufacturing capabilities to begin to climb that value chain, starting at the platinum refinery.

At this point, she believes, it is critical that South Africa focuses on the early stages of the platinum value chain. “What we are trying to do here is develop the intellectual property in South Africa based on platinum components, so that we have more control over where the materials and components are manufactured, and can build a sustainable industry,” she says.

As the UAV demonstrates, fuel cells are a very promising clean power source, with the potential to replace our current ‘dirty’ internal combustion

engines. A key component of these cells is platinum, which is converted into a catalyst – the first step on the platinum fuel cell value chain. The catalyst is a powder, which is then painted onto a membrane – the second step up the value chain to the membrane electrode assembly (MEA). The manufacture of these two simple first steps would have significant effects on the country’s economy.

According to **BCC Research** in 2013, at current fuel-cell market growth rates, the catalyst and ink market in 2017 will grow to \$265 million, and the MEA market to \$1.2 billion. This reflects about 9.5 times the original value of the raw platinum. We have an opportunity to participate in this market globally, thus increasing the value of goods currently exported from South Africa.

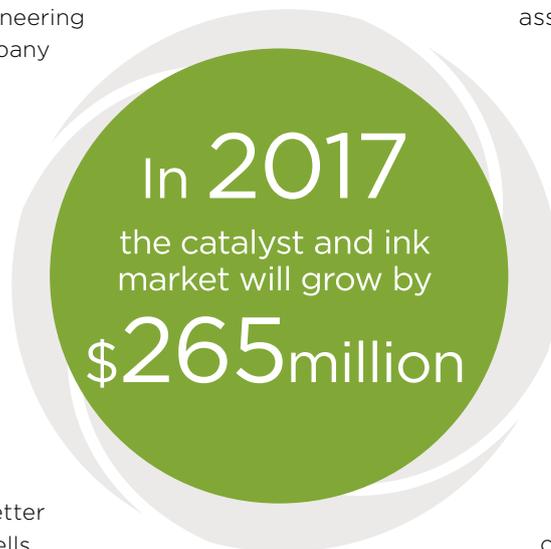
As it stands, says Blair, HySA/Catalysis has developed a family of platinum catalysts on a par with international products, and they are just beginning to sell these. The next step will be the membrane electrode assembly, and they are working with their first customers now to meet their needs.

The centre is also developing advanced fuel-cell components based on stainless steel and other materials that can be manufactured in South Africa. The promise of these technologies is starting to attract large global automotive fuel cell companies as partners, but the intellectual property will remain in South Africa.

“So while we know what components we can sell today,” she says, “we are also developing components for 10 years down the line.”

The focus on the early stages of the value chain is just one avenue of HySA/Catalysis’ strategy. The centre partners with foreign fuel-cell companies and introduces them to local companies that can participate in delivering components, all the way up through distribution to the end customer. These foreign partners agree to incorporate local technology into their products once it meets their needs. In 2015, Powercell Sweden installed their low-temperature fuel-cell system on a Vodacom mobile tower, using local company Powertech Systems Integrators. Powercell is also one of HySA/Catalysis’ potential MEA customers. HySA/Catalysis wants to see benefits for multiple players along the supply chain, and it is already well on its way to doing so. 

By Natalie Simon and Ambre Nicolson. Image of Alpha supplied by FlyH2.



Producing ‘T’-shaped graduates yields living gold



Since mining can affect all 17 sustainable development goals (SDGs) to varying degrees – both positively and negatively – it is poised to play an extraordinary role in achieving them, writes Dee Bradshaw.

To do so, it needs to go through a metamorphosis; from the current negative perception of mining as an environmental and socially compromising extractives sector, to that of a cornerstone of sustainable development, through supplying critical resources while generating significant multiplier effects across the broader economy.

For this to happen, the SDGs must be more than aspirational targets: they need to be ingrained in the culture and behaviour of all participants, and the appropriate technology needs to be developed and incorporated.

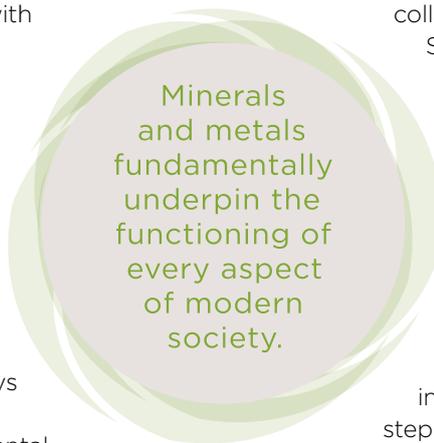
Minerals and metals fundamentally underpin the functioning of every aspect of modern society. In addition to the obvious contribution of smart devices and their connectivity, there is no means of generating energy without metals, whether using renewables or fossil fuels; and no agricultural, construction or manufacturing industry is possible. Even our health and well-being is dependent on the minerals and metals in daily use. As the incoming fourth industrial revolution accelerates and takes hold with increased technology, automation and connectivity, this need is expected to increase exponentially.

However, as part of the extractives sector, the mining industry globally faces multiple, multifaceted internal and external challenges. These include technical challenges, such as declining grades and difficult locations; financial and economic challenges, with cost escalations, delays and rising operating costs, and lower productivity; and social and environmental challenges, which include heightened competition for water, energy and land, growing scrutiny of the industry’s social and environmental performance, and an increasingly complex policy and regulatory environment. Although the sector makes a significant contribution to the macro, social and political economy, its long association with environmental disasters, human rights violations, unequal wealth distribution

and community conflicts tarnishes its reputation and threatens its licence to operate (LTO).

The key goal related to mining is SDG 9, with its aim being to build resilient infrastructure, promote sustainable industrialisation and foster innovation; but it is underpinned by many of the others. The Minerals to Metals Signature Theme is committed to doing just that, through the focused activities of innovative, integrated research, stakeholder engagement and postgraduate education. The research philosophy has a systemic, holistic view of mineral beneficiation that is underpinned by a fundamental understanding of the processes and development of the technologies supporting it. This includes our belief in the circular economy, and in working with urban as well as geological deposits. Our innovative technical methods and processes incorporate sustainability principles, building on the strong technical expertise of the research groupings in the Department of Chemical Engineering.

Our focus is on the interface between technology, society and regulation, as demonstrated by the collaboration between the two DST/NRF SARCHI Chairs: Mineral Beneficiation and Mineral Law in Africa. We produce ‘T’-shaped graduates who can operate from an integrated systems perspective, but also with a strong understanding of and competence in their discipline; they will be comfortable working outside their core discipline in multidisciplinary teams, as well as being mentally agile – able to identify and respond to non-intuitive opportunities that will provide step changes and lead the way in building a platform for sustainability through minerals and metals. They will join the community of practice equipped to lead, shape and sustain our world, developing our true legacy – living gold! 



Professor Dee Bradshaw is the DST/NRF SARCHI Chair in Mineral Beneficiation, and director of the Minerals to Metals Initiative.

Mapping mining to the SDGs: a preliminary atlas

Although mining can affect all the United Nations (UN) sustainable development goals (SDGs) either positively or negatively, it has an extraordinary potential to contribute to their achievement. UCT has participated in a global project: an atlas that outlines key focus areas for the mining industry within each of the 17 SDGs.

Mining can mobilise vast physical, technological and financial resources. It also serves as a catalyst to promote investment and innovation, and to stimulate the creation of jobs that will contribute towards the achievement of the SDGs and the broader 2030 agenda.

In order to help all stakeholders in the international mining sector navigate how to contribute towards these SDGs, *Mapping Mining to the sustainable development goals: a preliminary atlas* was conceived as a joint project and developed by the Columbia Centre on Sustainable Investment (CCSI), the UN Sustainable Development Solutions Network (SDSN), the United Nations Development Programme (UNDP) and the World Economic Forum (WEF). A draft was issued for public consultation in January 2016.

Having identified the opportunity, UCT has launched an initiative to assess the extent to which mining companies already contribute towards the SDG objectives, in both quantitative and qualitative terms. It will also identify ways in which the sector should adapt and improve, by implementing new operating procedures or methods, and embed the SDGs more effectively in governance, management systems, organisational culture and disclosure.

“The programme aims to inculcate this culture into the future leaders in the industry, by building the principles into every aspect of their engineering and business education, in both undergraduate and postgraduate course work and assignments,” says Adjunct Professor Mike Solomon.

Professor Dee Bradshaw, DST/NRF SARCHI Chair in Mineral Beneficiation, initiated workshops hosted at UCT to discuss the mining atlas, and submitted their contribution and additions to the atlas. “Our major contribution to the document,” she says,

“was the inclusion of the recognition of the role that universities and learning institutions have as a source of ideas and opportunities, and to convene and coordinate education, research and professional development that address mining and the SDGs.”

Solomon and Bradshaw met the partners in New York City in September 2015, and presented their work on operationalising the SDGs for further engagement and discussion of next steps. 



UCT team smashes eight-year water rocket world altitude record

A team from the Industrial Computational Fluid Dynamics (InCFD) research group has successfully broken the longstanding Class A water rocket world altitude record by a massive 33%, achieving a height of 830m.

“It is the first world record in rocketry set by a South African university that I am aware of,” says Professor Arnaud Malan, DST/NRF SARCHI Chair in Industrial Computational Fluid Dynamics, who led the research group. He adds that it is “definitely the first appearance South Africa has made on the international water rocket scene.”

The record was formally ratified on 7 October 2015 after international peer review by the Water Rocket Achievement World Record Association. The previous record of 623m, set in 2007 by US Water Rockets, has had no equal for eight years.

Says Malan: “The water rocket competition is very exciting and environmentally friendly, as it uses only water and air to reach incredible speeds. The competition is truly multidisciplinary, and requires pushing the boundaries of state-of-the-art technology in areas ranging from mechanical design and lean manufacture to computer-based mathematical modelling. It is like the Olympics of water rocketry: clearly, we are now the undisputed best of the best.”

Water rocketry provides a challenging postgraduate training platform, says Malan. The technologies it requires have several applications, including ultra-light pressure vessels for transport, catapulting cabling and ropes for construction and even novel thrusters for space applications.

As with most academic (rather than commercial) projects, this was done on a shoestring budget: the rocket was built from off the-shelf-components and using standard tooling.

The result was a featherweight, record-breaking rocket that is 2.68m tall, yet weighs less than 1.5kg, including a flight computer, on-board camera, parachute and parachute deployment system.

The rocket produced 550kg of thrust – enough to lift a small car off the ground – and blasted off to 550km/h in under 0.5 seconds (it could cross a rugby field in three-quarters of a second). The team made extensive and creative use of carbon fibre materials, due to their amazing strength.

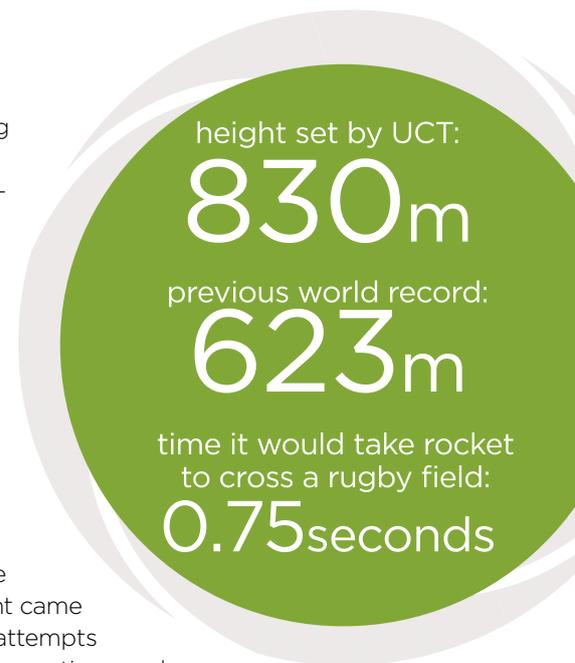
The record was the end of a long journey for the research group – driven by Stuart Swan and Malan, with assistance from Donovan Changfoot and William Liw Tat Man, all based at the Department of Mechanical Engineering. The successful ascent came after two failed attempts and numerous innovations and refinements, in a process that tested the team’s perseverance.

The first attempt – in November 2013 – failed because the carbon-fibre rocket vessel was leaking air severely. To resolve this, the team devised a creative and cost-effective sealing solution (for which a patent is currently being applied).

A second attempt, which sported a significantly improved launch pad – important for the large forces expected – was aborted when the rocket failed to lift off. A number of innovations, ranging from pressure-vessel manufacture to a radical fail-safe parachute deployment system, led to the development of Ascension III.

On 26 August 2015, the team headed out to Elandsberg Farms in the Western Cape. The first flight achieved a height of 835m – 217m higher than the previous record. To secure the world record, a second launch had to be completed within two hours of the first. With 10 minutes to spare, the second launch took place and reached an altitude of 825m, setting a new world record of 830m. 

Story by Carolyn Newton.



[Watch video here](#)

Using FM radio broadcasts to make air traffic control safer for Africa

Africa has the highest accident rate per flying hour in the world, and the lack of regional air traffic is crippling development in Africa. In the meantime, FM radio broadcasting is experiencing a meteoric rise, serving as the dominant mass medium in Africa.

These two facts may seem unrelated, but to members of the Commensal Radar Project, the proliferation of FM radio waves can in fact provide affordable and safe air traffic control in Africa and the developing world.

Developing an alternative system

Very few African countries other than South Africa have radar systems installed at their airports. As it stands, pilots flying across the continent have to rely on a manual system to avoid aircraft collisions. “The pilots know who is taking off from where, and when, and they talk over the radio to coordinate their routes,” says Professor Michael Inggs of the Department of Electrical Engineering and the Radar Remote Sensing Group.

He stresses that this is a situation that cannot continue: “As the continent develops, we will see a massive growth in air traffic,” he says. But a radar system can cost around \$10 million – prohibitively expensive for many developing countries.

Inggs and his team at the Commensal Radar Project, a collaboration between UCT, the Council for Scientific and Industrial Research (CSIR) and Peralex Electronics, have developed an alternative radar system – using FM transmissions, and a number of receivers spread out across many hundreds of kilometres and connected by cell phone links – to track the location of aircraft, with an accuracy of 100 metres or closer. This, says Inggs, is more than adequate for air traffic control safety standards. Work is currently underway to commercialise this technology.

Building the Commensal Radar

The Commensal Radar Project started around the year 2000. Inggs read about a researcher in Europe who was using television signals to track aircraft, and began to investigate a similar solution for Africa. “For technical reasons, I found using FM more effective than television signals,” he says. The aircraft reflects the FM signal, which

can be picked up through a receiver. At the same time, as the aircraft moves through the signal, a phenomenon called the doppler shift occurs. This is a change in the frequency of a wave, such as a sound wave or a radio wave, depending on the speed of an object and the position of an observer. The simplest example is an ambulance siren: when the ambulance is coming towards you, the pitch of the siren is different from when it is moving away from you.

“The term ‘commensal’ is biological,” explains Inggs. “It refers to a system where two organisms share a relationship in which one may benefit from the existence of the other, but the organisms don’t affect one another.” This perfectly describes the relationship between the receivers of the Commensal Radar Project and the FM radio transmitters. The project’s receivers use the FM transmission to track aircraft, but the transmitters themselves are not affected by this – they simply keep transmitting pop music and talk shows to listeners.

Exceptional problem solvers

The project faced a number of challenges, most of which were solved by a sequence of exceptional PhD students grappling with the applied mathematics problems faced in the project – including Craig Tong, who worked on developing the software to receive and process the signals. Francois Maasdorp resolved the ambiguity over pinpointing and tracking a single aircraft when there are other aircraft on an ellipse around it (This mathematical challenge was based on the work of a PhD student from Chad, Roaldje Nadjiasngar.). The final step was a demonstration, tracking South African Airways planes coming into Cape Town.

It is for this work that the Commensal Radar Project was awarded Gold at the annual AVI (Africa Aviation Innovation) Awards in late 2015. The project has also just been awarded the **IEEE Harry Rowed Mimno Award** for clear dissemination of technical material. 

By Natalie Simon. Image by Hansueli Krapf, Wikimedia Commons.

Big developments in big data: astronomy and data science in Africa

The Square Kilometre Array (SKA) project will produce data at a rate comparable to that of global internet traffic. But if we don't have the infrastructure and skills to deal with it, the data will go offshore; Africa will lose this stellar science and business opportunity. Three South African universities have formed a new institute to ensure that Africa will be able to meet this challenge, with benefits for the continent that go far beyond astronomy.

"The data revolution is set to be a globally transformative phenomenon - if you don't ride the wave, you're going to be flooded by it," says Professor Russ Taylor, director of the recently launched Inter-University Institute for Data-Intensive Astronomy (IDIA). IDIA, a partnership initiative between the University of Cape Town (UCT), the University of the Western Cape (UWC) and North-West University (NWU), is a flagship project to respond to the immense big-data challenge of the [Square Kilometre Array \(SKA\)](#) - a global endeavour to build the world's largest radio telescope - in South Africa.



The institute aims to ensure South Africa is ready not only to ride the big-data wave, but to drive it, says Taylor.

Big data refers to the large, complex data sets – created and collected through technology – that are set to affect every aspect of life. But the SKA poses a particular challenge: tasked to collect data from deep space-dating back to the very start of the universe 13 billion years ago, the SKA will collect around 1.5 exabytes of data a year – that is, roughly one and a half billion gigabytes.

South Africa, as co-host (with Australia) of the SKA, is thus uniquely placed to lead the global response to big data – an opportunity we dare not miss.

Preparing for data sharing

It is this precise situation the IDIA seeks to avoid. “At IDIA, we are essentially laying the groundwork – in terms of both infrastructure and human resources – to be ready when the SKA turns,” says Taylor.

The real challenge, explains Taylor, is not just to build a big pipe to manage the data, but to store it in a way that enables the global collaboration required for a project of this magnitude.

“Teams in Africa, Europe, Asia, Australia and North America all want to work together on this data. So the issue is not only how to store and manage the data, but how to enable collaboration on a big data set that nobody can actually have on their desktop,” he says. “What this means, in practice, is that we need to build new cyber-infrastructure platforms.”

The first of these platforms is the Africa big data Research Cloud (ARC), the first phase of which is housed in UCT’s cloud-based data centre. The ARC gives researchers the ability to develop collaborative research environments in which they can share data, computational capabilities and other tools, unimpeded by the restrictions of time and space. It is envisioned to grow to include the eight African partner countries on SKA, and a number of SKA partners in Europe.

Developing data scientists

IDIA is also focused on building the skills needed for the new digital world of big data. “Big data will fundamentally change the way we do science,” says Taylor. The world is witnessing a global shortage of data

scientists – a job description that didn’t even exist just a decade or two ago. IDIA is set to remedy this shortage: firstly, through the recruitment of graduate students and postdoctoral researchers to work on the data challenges; and secondly, by putting in place programmes to train people in this new specialisation. From 2017, UCT will offer a master’s degree in data science, while Sol Plaatje University in the Northern Cape recently created a dedicated undergraduate degree in data science.

The sexiest job of the 21st century

The *Harvard Business Review* has described “data scientist” as “the sexiest job of the 21st century”. This skill set is sought after in just about every industry the world over, from tourism to marketing to astrophysics. A study by McKinsey projects that by 2018, the United States will face a 50% gap between supply and demand for individuals with strong data-analysis expertise. By offering this data-science speciality, South African universities seek to fill not only a niche created by the SKA, but a global skills shortage.

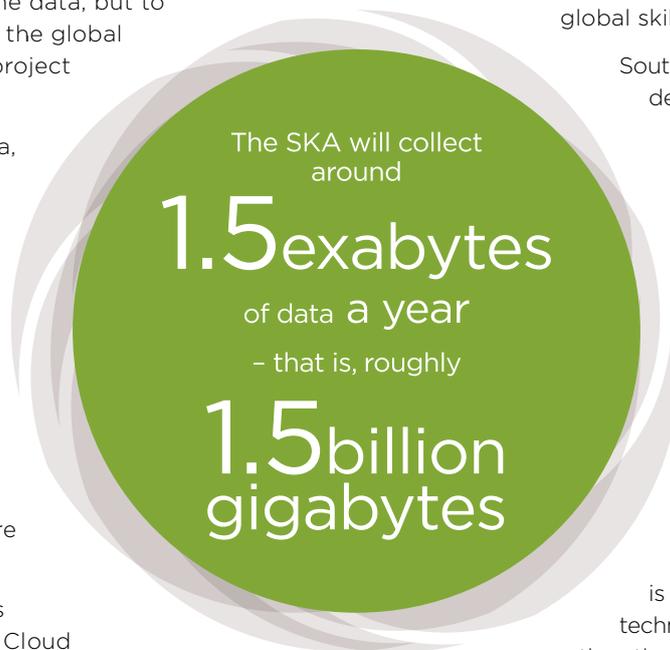
South Africa stands to gain a great deal from taking full advantage of the SKA and the big-data challenge. A large part of the rationale for this country’s comprehensive investment in the SKA project is the benefits that will accrue as a result of the project, which extend far beyond just the astronomical.

“There are three elements of development in the SKA,” says Taylor. “The first is the development of the technology to build the project; then there is that of the scientific outcomes, and the ownership of these outcomes; and finally, the development of skills that comes from the requirement to utilise such sophisticated equipment.”

Such skills are primarily in information and communication technologies, and investment in these skills is a long-term investment, he explains. For South Africa to reap the rewards, we need to engage fully.

“At the core of it,” says Taylor, “IDIA is about building the capacity to ensure that we in Africa are ready to engage in and benefit from one of humanity’s most ambitious science projects to date – taking place here, within our borders.”

By Natalie Simon. Image by SKA South Africa.



The role of space technology in meeting SDG targets

The link between space technologies and the sustainable development goals (SDGs) may not be obvious, but space tech may provide the key to achieving a number of these goals, writes Peter Martinez.

Space technologies today touch the daily lives of ordinary citizens around the globe – in fact, they are so embedded in our information society that most people are unaware of how reliant we have become on them. It goes far beyond the satellite pictures shown on the daily TV weather forecast. Cell-phone networks, the internet, financial institutions, electrical power utilities, street- and traffic-light networks, aviation and maritime navigation are just some of the utilities and services that rely on data from space systems.

Remote sensing satellites provide global coverage of the Earth, and allow us to detect and study changes in the Earth's climate, atmosphere and oceans. Earth-observation satellites support the development and negotiation of treaties for environmental protection, and can be used to monitor compliance with and document violations of environmental and security-related treaties.

Global-navigation satellite systems support synchronisation of terrestrial networked infrastructures, improve aviation and maritime navigation and safety, enable more precise cartography, and support search-and-rescue operations.

No longer a luxury

Satellite technology is also extensively used in early-warning, monitoring, assessment, response and recovery operations for natural and humanitarian disasters, and has been used to save many thousands of lives.

Because of high entry barriers, space technology has been seen as a luxury in the past, and the development-aid sector has tended to shy away from it as being too 'high-tech' for developing countries. However, these technologies can now be seamlessly integrated with familiar terrestrial technologies, such as GPS on smartphones.

Far from being a luxury for developing nations, therefore, space technology is, in fact, an essential contributor to meeting the SDGs. It provides the modern infrastructure of the information society, and today's satellites, ground stations and data centres provide the basic infrastructure to acquire, receive and process space-derived data that is turned into useful information for citizens – be it a weather forecast for a fisher, or a market forecast for a farmer.

This is as important in the 21st century as the development of roads, bridges and harbours were to the development of industrialised economies in the 20th century.

In January 2016, the African heads of state adopted the new African Space Policy and Strategy, which provides a vision for harnessing space science and technology for the development of Africa. Against this backdrop, a group of postgraduates at the UCT SpaceLab has been examining ways in which space technologies can be harnessed to meet the SDGs in Africa.

They identified food security as a theme that could be used to support the achievement of several SDGs, and have proposed the development of a Space-based Agricultural Information and Monitoring System for Africa (SAIMSA). This envisages an open-source cell-phone/tablet application that will empower farmers with critical information on climate and farm conditions, allowing them to make informed decisions that will increase their yield, and develop contingency plans for extreme weather events. There will also be a link in the application to financial markets, which will allow farmers to access financial information to help them with commodities trading. 



“Far from being a luxury for developing nations ... space technology is, in fact, an essential contributor to meeting the SDGs.”

Professor Peter Martinez is founder and head of the UCT SpaceLab, in the Department of Electrical Engineering.



Life below water and life on land

SDG 14: Conserve and sustainably use the oceans, seas and marine resources

SDG 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

Wildlife solutions for a crowded planet

A centuries-long war has been ongoing in the Western Cape province of South Africa – a war that pre-dates apartheid, the South African war and the militaristic rise of the Zulu Kingdom. It is a battle between humans and baboons over territory and food; just one example of conflict between people and wildlife on our crowded planet.

Most of the Cape Peninsula, which used to be the baboons' natural habitat for foraging and breeding, has been taken over by the growing population of humans, and baboons have been pushed into the peripheries, particularly into mountainous areas, where food is scarce.

"The baboons have been marooned by a rising tide of humanity," says Justin O'Riain, professor in the Department of Biological Sciences and director of the new Human-Wildlife Institute. "They are trapped on the higher reaches of mountainous areas – like small islands in the seas of human settlements – and even there, humans occasionally spill over into the land set aside for them and other wildlife. When they are forced to descend during lean times, they encounter dense residential areas with their easy pickings, which sets the scene for chronic levels of conflict."

It is to help find a balance between human and wildlife needs that the new Human-Wildlife Institute was formed. It will pull together expertise from a range of disciplines, firstly to understand the drivers of conflict, and then to engage with managers and policymakers to devise sustainable solutions for local, national and global conservation conflicts.

"We used to study interactions only between humans and wildlife," explains O'Riain, "and through collaboration with colleagues in the humanities, we have learnt the importance of understanding the conflict that exists between humans on how best to approach long-standing conflicts between people and wildlife."

A complex world of conflicts

O'Riain first tasted the complex world of conflicts in conservation when his students got involved with the study of the chacma baboon crisis in the Cape Peninsula more than 10 years ago.

"Our initial interest was purely biological; however, we soon discovered that the biggest battles were in the boardrooms, as different philosophies and approaches were contested for managing the population. One of the core problems was the public's lack of understanding of



the baboons' situation. Through applied research and public engagement, we could empower communities to become informed and actively contribute to policy change."

They also provided expert advice on baboons for management plans, protocols and policy documents, and soon recognised that they also needed to bring other experts on board. "When you have a sociologist, economist, biologist, philosopher and psychologist all working together," says O'Riain, "you begin to see long-term solutions, when previously there was only a wicked problem."

The team worked closely with the City of Cape Town, South African National Parks and CapeNature and published data that has informed both policy and management interventions to reduce conflict on the Cape Peninsula. "Such was the success of the collaboration," he says, "that the ethos has permeated provincial and national policy."

The team has since been involved in a number of other human-wildlife conflict challenges in the Western Cape, most notably in the drylands of the Karoo, where Associate Professor Beatrice Conradie, director of the Sustainable Societies Unit in the School of Economics, and Nicoli Nattrass, professor of economics at the Centre for Social Science Research, were breaking new ground on one of South Africa's oldest problems - predators and livestock.

"When you have a sociologist, economist, biologist, philosopher and psychologist all working together ... You begin to see long-term solutions ..."

The leopard and the lamb

In the Karoo, land is mainly used for low-density livestock farming, which allows indigenous wildlife to persist, including predators such as leopard, jackal and caracal.

"This has produced one of the most pervasive and complex conservation conflicts in South Africa. It threatens the sustainability of livestock farming, impacts adversely on wildlife welfare and fuels conflict between government, non-governmental organisations, society and academics on both the causes of, and appropriate management responses to, predation in arid farmlands," says O'Riain.

It is here that the researchers have revealed the value of an interdisciplinary team for tackling complex problems. From farmers' stoeps to remote Karoo town halls, they are shedding new light on the murky intersection of sociology, politics, economics and biology in the drylands of South Africa. "Any one of us working alone would be severely limited in our understanding of the collective challenges," says O'Riain, "but together we provided a new approach, firstly to understanding the extent of the challenges facing small livestock farmers, and secondly

providing alternatives that will benefit wildlife, domestic animals and the people of the Karoo."

The SKA conservation challenge

The internationally acclaimed Square Kilometre Array (SKA) project poses another interesting conservation challenge.

"The project has acquired a large number of private farms to create a contiguous 'quiet' area within which the radio telescopes are being constructed," says O'Riain. "This land, which has been used for farming for more than 400 years, will now be returned to a more natural state. We will partner with the South African Environmental Observation Network to monitor the response of mammals to this changing landscape. We also aim to explore how the presence of a newly established conservation area within a small farming area will impact on levels of conflict between predators and livestock."

The Human-Wildlife Institute has also been invited to provide biodiversity data throughout the proposed fracking (shale gas development) footprint, as part of a joint venture with the South African National Biodiversity Institute, the Department of Science and Technology and the Council for Scientific and Industrial Research. "This represents one of the most ambitious biodiversity assessments ever to be undertaken in Southern Africa and will link with the National Research Foundation's Foundational Biodiversity Inventory Partnership Programme." It will provide important information of how land use impacts on biodiversity and will complement current research on the farms of the Karoo.

Coastal conflicts

The institute will not be limited to terrestrial systems and has established links with shark researcher Dr Alison Kock. Apex predators on land and in the ocean are particularly vulnerable to persecution, because they not only compete with us for food, but occasionally include us on their menu.

"Our current research on white and seven-gill sharks extends from the basic biology of both species to the impacts on people associated with rare attacks," says O'Riain. "While we have a good understanding of shark ecology in False Bay, we are in urgent need of a better understanding of the economics and human dimension of shark incidents if we are to keep Cape Town as a city committed to non-lethal management of the apex predator on our doorstep." 

By Birgit Ottermann. Image by Dan Mitler, Flickr.



Smartphone app empowers small-scale fishers

Small-scale fishers have a low carbon footprint and play an important role in the food security, economy and culture of coastal villages; yet they remain a marginalised group in South Africa – lacking rights, a say in the management of their resources, and empowerment in the market chain. Dr Serge Raemaekers is working with fishers and government to develop a smartphone application that will empower the fishers, and possibly completely change the power dynamics in their sector.

If you take a look at the menu of your average restaurant in just about any coastal town, you'll find more or less the same variety of fish: hake from an industrial fishery, calamari imported from places such as Argentina, Mozambican or Asian prawns; and then linefish, possibly caught by small-scale fishers, but sourced through a series of middlemen. What you generally *won't* find, according to Raemakers, a lecturer/researcher in the Department of Environmental and Geographical Sciences, is high-quality, fresh linefish, sourced directly from local small-scale fishers.

This disempowerment and marginalisation suffered by small-scale fishers began long before the apartheid days, says Raemaekers, and has continued into the democratic dispensation, as post-1994 deliberation regarding fisheries was strongly dominated by industry

and organised labour. Both groups resisted the redistribution of resources to traditional, small-scale fishers – who at that time were not well organised – and the post-1994 fisheries policies reflected this bias.

In 2004, a group of small-scale fishers turned to the Equality Court to fight for their right to earn a living through fishing. The fishers were successful in the court battle; and in 2007, government embarked on a five-year participatory process, which culminated in the development of a small-scale fisheries policy focused as much on human rights and socioeconomic development as on fish stocks and sustainability. "This policy is a radical paradigm shift," says Raemaekers, who served on the government-established national task team responsible for drafting the new small-scale fisheries policy. "The development of the policy was an intensive

participatory project, but it doesn't stop there. The next challenge lies in implementation."

Abalobi app

It was thinking about the challenges of policy implementation that led Raemaekers, together with Abongile Ngqongwa, a fishery manager from the Department of Agriculture, Forestry and Fisheries (DAFF), and fisher and community worker Nico Waldeck, to the idea of creating a smartphone application (app) to be a one-stop shop for small-scale fishers to record their catches, engage with government at the co-management table, enhance their safety at sea and explore different value-chain opportunities. The app is called 'Abalobi', the isiXhosa word for small-scale fishers, as referred to in the policy.

"There are two major problems with the small-scale fishing sector that spurred us on to work on the development of Abalobi," says Raemaekers. "The first is the big gap between scientific knowledge and local fisher knowledge. The very contextualised local knowledge does not make its way into fisheries management; but also, the scientific understanding of fish-stock models does not always gel with the local knowledge owned by fishers." Part of what Raemaekers and his team hope to achieve through Abalobi is to build trust between the relevant role players, including government and scientists, creating relationships where groups can work together to complement different knowledges and local data, and to achieve greater understanding of fish resources and of how best to implement policy.

Stuck in a system of servitude

A second gripe for Raemaekers is that small-scale fishers are mostly 'price-takers', stuck in a system of servitude in which they are just working to pay back last year's loans. "These fishers don't often get a good price for their catch. Even though this is potentially the most sustainable and socially just fishing practice in our inshore waters, these small-scale fishers are not empowered in the value chain."

Simple information-sharing and communication between fishers could free them from this trap. As part of the Abalobi project, chat (smartphone-based instant messaging) integration was developed that allows fishers – who had previously had no contact with each other – to communicate with one another.

Raemakers tells a story of a group of fishers in Struisbaai, part of the pilot programme, who used this tool to set a minimum price for their linefish – before the first boat came into the harbour. "It sounds so simple," he says, "but for these fishers, it was a total shift in the power dynamics. They all worked together, and got a better price." There are knock-on effects, too.

As fishers from different parts of the coastline start communicating, they also begin sharing information and skills to help one another. These fishers may never have met, but they are in the same sector and working towards the same goal.

Abalobi, which is still in the pilot stage, has a number of planned modules. One of the core modules currently being pilot-tested is Mobile Catch Reporting, through which both fishers and government monitors capture data and access easy-to-understand dashboard analytics. At the moment, these processes are separate: the fishers capture their information about a catch, and they own that data. They decide who can see it and how it is to be used. At the same time, government monitors are also capturing data. "The plan is to have regular workshops for engagement between government and fishers, to discuss the data – what the differences are, and why," explains Raemaekers. "We are embarking on a process of building trust, co-producing knowledge and working together to ensure responsible governance of the sector."

Transdisciplinary endeavour

Other modules include a focus on safety at sea, connecting fishers to markets and consumers, and building a knowledge hub for fishers to keep on top of the latest trends and regulations. On Abalobi, Raemaekers has been working closely with both the fisher community and the DAFF. The key for him is that this is not an academic exercise, but a community-owned and -led open-source project. "This is a really transdisciplinary endeavour," he says. "Abalobi not only brings together scientists, government, industry and community, but also encompasses natural sciences, social sciences and information technology.

"This is not about a team of IT people developing yet another app. Abalobi is a project by the small-scale fishing community themselves, to own the process of implementing the policy they fought for." The Abalobi project (www.abalobi.info) is currently funded through Raemaekers' NRF research grant, with support from DAFF's small-scale fisheries directorate. The project will require dedicated funding to enable a full-scale roll-out. 

"The very contextualised local knowledge does not make its way into fisheries management."

By Natalie Simon. Image by Michael Hammond.

Peace parks and people's rights

Southern Africa's peace parks have given animals a regional passport to move freely across international borders. Wildlife migration routes have been restored, and previously fragmented ecosystems reconnected. And yet the people who used to call those regions home are not enjoying the same liberties. Instead, they have been disconnected from their environment and heritage, and their clans remain separated by political borders.

"We have unified policies around wildlife and management, but are reluctant to do the same for people," says Maano Ramutsindela, professor of environmental and geographical science. "Every peace park should be obligated to contribute to the communities on both sides of the border in a meaningful way."

A geographer by training, Ramutsindela has always been fascinated by the social side of geography.

"I am very interested in how geography impacts on people (whether it be where they live, land issues or access to resources) and how it is often involved in the creation of spaces of conflict and violence. One of my first interests in conflict was actually the drawing of provincial and municipal borders – a conflict that is still ongoing today. Every time there is a demarcation, there is conflict!"

Ramutsindela developed an interest in peace parks as they were changing the geography of the region, transcending colonial borders and reuniting ecological systems. "What attracted me as a researcher to the peace parks project was that it was recreating space; not just for the animals, but also for the people of the region. Moving people from one space to another impacts on their identity and how they live."

As an example, he mentions the apartheid government's policy of restricting people to living in certain areas: "Over time, people got used to that new space and started to believe that it was 'normal' – the way they really should be living. But what happened to their resources?"

When you take away people's resources, whether it be through political ideology, conservation or other means, they have to adjust to a new way of living; and



this holds consequences for both the people and the environment itself.”

According to Ramutsindela, the peace parks project came at just the right time, as it brought together all the questions he was grappling with.

“The mission of transfrontier conservation areas (peace parks) in southern Africa is very noble. It aims to promote biodiversity, sustainable development and peaceful co-existence. However, not enough thought was given to the impact these new spaces would have on the people who previously inhabited them,” says Ramutsindela.

Empowering local people

“While the animals gained habitat, the locals in these remote areas lost theirs, and received very little in return. The few who can read and write can work in the peace-park projects, or as tour guides; but the ordinary people who would have otherwise used the land to feed their families are left impoverished and desperate. These are the same people who until very recently witnessed the violence, torture and killings inflicted by South Africa’s apartheid government on the country’s borders – atrocities that have never been addressed properly.”

Ramutsindela remarks that these same violent tactics are now used to combat rhino poaching and defend the peace parks. The Kruger Park, which is the core of the Great Limpopo Transfrontier Park between Mozambique, South Africa and Zimbabwe, has rapidly militarised, in a desperate attempt to save endangered rhinos from poachers.

“While saving the rhino is a very important conservation effort, we must also start empowering and including the local people. If we keep ignoring them, we are sending out the message that they don’t matter – that we only care about the animals and the environment. Frustration and anger will increase, which in turn will fuel the conflict in an already unstable region.”

The majority of the communities in those remote areas are very poor; and on losing their land, have no way to provide for their families. As a result, it is said that they are easily tempted to get involved in illegal activities such as harbouring poachers for quick money.

Ramutsindela warns that this has become a vicious circle. “As the poaching crisis intensifies, more land is acquired to create buffer zones against the poachers. As a result, more people are losing their land and livelihood ... and so the conflict continues.”

He suggests that local people be given some basic rights and responsibilities, via benefit-sharing schemes that have minimum guarantees. “Some kind of ethical code is necessary. If people have some rights to the land and earn some benefits, they will appreciate



conservation efforts, as well as develop a sense of dignity and purpose.

“In Namibia, for example, the government has given local people wildlife rights. They don’t own the land, but at least they have access to the land and the animals, while also looking after them – they are part of the conservation process.”

Ramutsindela also believes that the semi-nomadic lifestyle of ethnic groups such as the Nama and San should be recognised, by allowing them to migrate freely across the borders. “The San’s habitat, for example, has always been the Kalahari. Open it up for them!” (The Kalahari stretches over parts of Botswana, Namibia and South Africa.)

He remarks that people in general are very unwilling to express criticism when it comes to conservation and (especially) the peace parks.

“Though it is a great project, it has had unintended consequences, and we should not be afraid to address those, and ask the difficult questions. We need to bring about more peace in the parks. We have succeeded in redefining the borders for wildlife; now we must do the same for the communities that are still divided by those borders. Involving and improving the lives of the local people will help to increase stability in the peace-park regions, and reduce the potential for future conflict.” 

By Birgit Ottermann. Feature image by [Wegmann](#), Wikimedia Commons. Image of researcher by [Michael Hammond](#).

How plants dupe dung beetles into burying their seeds

A Cape restio (*Ceratocaryum argenteum*) produces large, hard nuts that smell and look remarkably like dung. They are often buried by dung beetles, though they provide no food for the dung beetles or their larvae – a classic example of biological deception, and possibly one of the best examples of faecal mimicry for seed dispersal anywhere in the world. They were recently described by biologists in a paper in *Nature Plants*.

Deception is a very interesting biological phenomenon, as it involves a co-evolutionary arms race between one species (the deceiver, or mimic) that benefits from resembling another species (the dupe, or model), with no advantages for – and sometimes even to the evolutionary disadvantage of – the latter. Some of the most striking examples of deception in plants are those that deceive insects into pollinating flowers without any reward.

Some orchids, for example, produce colourful flowers that contain no nectar to reward pollinating insects. These plants rely on sensory exploitation (insects are attracted to colour in general), and in some extreme cases, mimic other rewarding plants that occur in the same place, thereby duping insects into pollinating their nectarless flowers.

Deception for seed dispersal, however, is far less common. Some plants produce hard red or black seeds (such as the so-called 'lucky beans') that look like berries; but these do not seem to fool birds, and are hardly ever eaten or dispersed. Also, such seeds are often poisonous, and their bright colours act more as warning colouration than as an attraction to fruit-eating birds. Dung beetles being duped into dispersing 'dung-like' *Ceratocaryum* nuts may therefore be the best example globally of faecal mimicry for seed dispersal.

The scent of *Ceratocaryum* nuts is very strong. "I have nine-month-old seeds in a paper bag in my office that are still very pungent," says Jeremy Midgley, a professor in the Department of Biological Sciences, who discovered the deception. Steve Johnson, a professor



at the University of KwaZulu-Natal (UKZN) who did the chemical analyses for this study, was amazed at both the complexity of the scents emitted by *Ceratocaryum* seeds, and their similarities to antelope dung. “It still remains to be seen exactly which chemical is the most attractive to the dung beetles,” says Johnson.

“I have long had an interest in seed burial by certain Cape rodent species, and was convinced that the enormous size of *Ceratocaryum* seeds would make them attractive to rodents – either to eat immediately, or to bury,” says Midgley. Together with MSc student, Joseph White and small-mammal expert, Dr Gary Bronner, both in the Department of Biological Sciences, he began investigating whether free-ranging small mammals were interested in *Ceratocaryum* nuts.

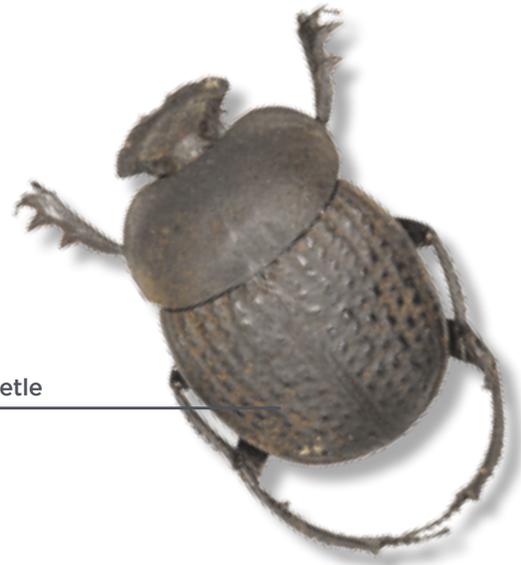
“We used motion-sensing trail cameras to observe small-mammal interactions with the nuts under field conditions, and it seemed that they were disinterested or even repelled by the seeds. When small mammals did crack seeds open, it was clear they were interested in the nutritious inner parts of the seeds,” says White.

The most surprising result from their field experiments was the discovery of dung beetles dispersing *Ceratocaryum* nuts. “Through both camera trapping and direct observation, we saw dung beetles being attracted to the nuts, rolling them away and then burying them, by pulling them down from below,” comments Bronner. “Previously, we had observed the same behaviour by another dung beetle species in the Cederberg, where *Ceratocaryum* plants do not occur; suggesting that this phenomenon may be quite general and widespread in fynbos.”

“I wonder what would happen if we put these nuts out in the savanna?” ponders Midgley. “Would they fool savanna dung beetles?” Dung beetles do inadvertently disperse some seeds – for instance, those already in the dung of fruit-eating mammals, which the beetles bury to nourish their offspring. But this is not deception, as the beetles gain a reward. With *Ceratocaryum* nuts, however, dung beetles are duped into dispersing and burying nuts with no reward, but with an energy cost.

“This type of dispersal is probably quite rare, because it depends on the right ratio of dung to dung beetles. Too much dung, and the nuts will not be buried – because beetles have too much of a choice; too little dung, and there will be a similar lack of burial, owing to too few dung beetles. We still have much to learn about the dynamics of such faecal mimicry,” concludes Midgley. ○

By Carolyn Newton. Images by Joseph Douglas, Mandla White.



The beetle



The seed



The dung dupe

VIDEO: Watch camera-trap footage of the small mammal *R. pumilio* dehusking *Ceratocaryum* nuts.

VIDEO: Watch camera-trap footage of a dung beetle burying a *Ceratocaryum* nut.

Scientists uncover the genomic blueprint of bat-wing development

Linked studies identify gene regulatory switches that turn bat genes on and off at crucial times during limb development, with implications for understanding how differences in the size, shape and structure of limbs are generated in mammals in general, including humans.



An international team of scientists from the University of Cape Town (UCT) and the University of California, San Francisco (UCSF) has, for the first time, identified both genes and gene regulatory elements that are essential in wing development in the Natal long-fingered bat (*Miniopterus natalensis*), a species widely distributed in east and southern Africa.



Bats are the only mammals capable of powered flight – an ability that evolved about 50 million years ago. The structure of the bat wing, as noted by Charles Darwin in 1859 in *On the Origin of Species*, is widely used among biologists as an example of both evolutionary novelty (the appearance of a new trait) and vertebrate homology (shared ancestry between two seemingly different structures) – in this case, the wing of the bat and the forelimb of other mammals.

Mining the origin of flight in mammals

The path of bat evolution is unclear, says Professor Nicola Illing, co-senior investigator based in the Department of Molecular and Cell Biology: “The fossil record does not show the transition from tree-climbing mammals with short, free digits to ones that have elongated fingers supporting a wing. We have had the privilege of being able to use the tools of modern genetics to decipher how genes are turned on and off during bat embryonic development, to transform a mammalian forelimb into a wing.

“While some attempts have been made to identify the molecular events that led to the evolution of the bat wing, these have primarily been done on a ‘gene by gene’ basis,” said co-senior investigator Nadav Ahituv, a UCSF professor of bioengineering and therapeutic sciences and faculty member of the UCSF Institute for Human Genetics.

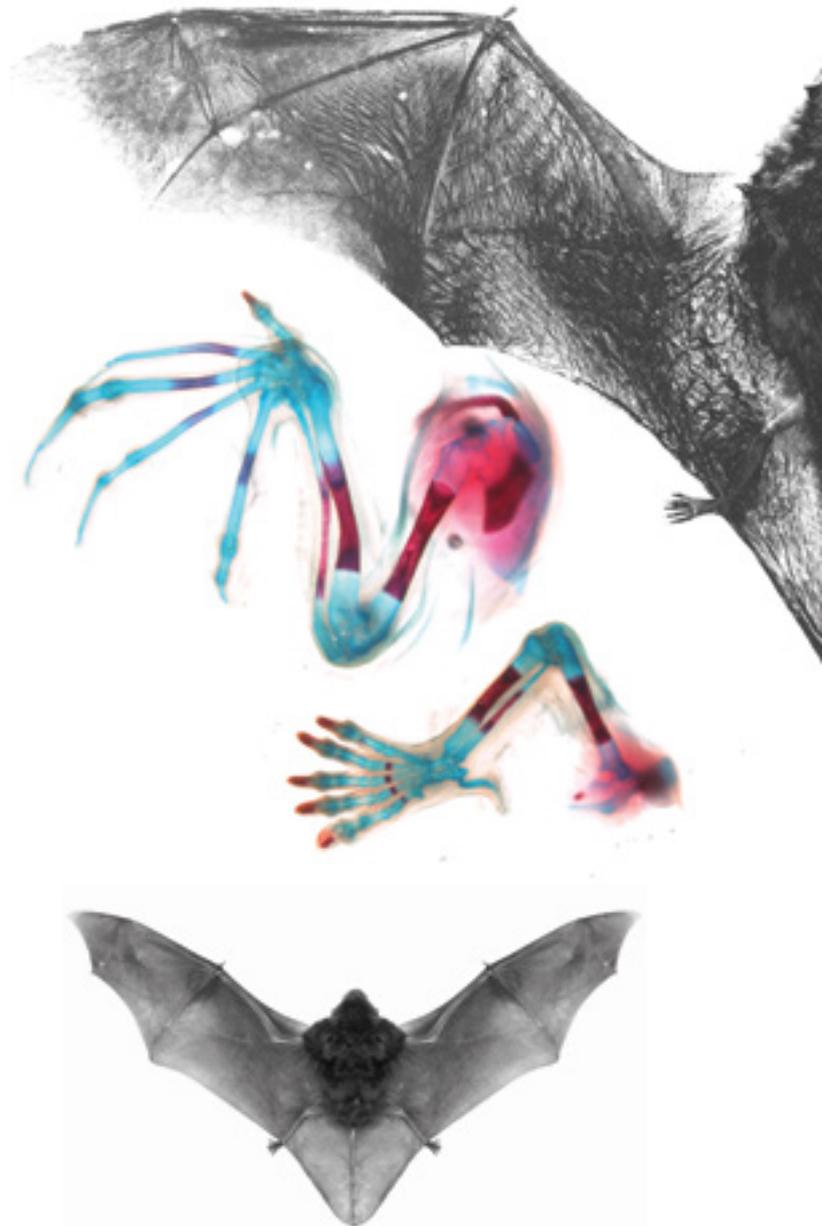
“This work lays out a genome-wide blueprint for the causes that led to the development of the bat wing, a key evolutionary innovation that contributed to bats becoming the second most diverse order of mammals.”

Over 7 000 genes identified

The researchers identified over 7 000 genes that are expressed differently in forelimbs compared to hind limbs, at three key stages of bat-wing development. They found that many signalling pathways are activated differentially as well, including pathways important in limb formation, digit growth, long-bone development and cell death.

It took bats millions of years to evolve wings. This research shows that they did this through thousands of genetic alterations, involving both genes used by all animals during limb development, and genes whose usage in limb development may be unique to bats.

“This gives us our first detailed picture of the genomics behind bat-wing development,” said Ahituv. “Importantly, this work identified not just which genes are expressed at what stage of growth, but the genetic switches in the genome that are responsible for turning those genes on and off.”



“It is gratifying seeing this work come to fruition after a decade of research,” says Illing.

Ahituv agrees: “This work will increase our understanding of how alterations in limb development could lead to limb malformations in humans. Potentially, it could eventually help contribute to the development of tools and techniques to prevent such malformations.”

Read more about this research in The Washington Post, or access the original research papers in the [Nature Genetics](#) and [PLoS Genetics](#) journals.

Shortened version of [UCT/UCSF media release](#). Images supplied by Nicola Illing (UCT) and Nadav Ahituv (UCSF).

Flight risk

The martial eagle project continues to make strides in determining the causes driving the decline of Africa's largest eagle in protected areas such as the Kruger National Park.

Rowen van Eeden, a PhD student at the Percy Fitzpatrick Institute of African Ornithology and his supervisor, Dr Arjun Amar hypothesise that perhaps the most important factor driving these declines is the high mortality of juveniles beyond protected areas, when they disperse in search of vacant territory.

The long-range dispersal of juveniles has now been well established using GPS tracking devices, confirming previous findings from re-sightings and recoveries of ringed juveniles that revealed that martial eagles often disperse far from their natal site. The tracking data show that after leaving their natal territory, young martial eagles traverse areas of up to 6 500 square kilometres, and many immature birds from Kruger spend more than half of their time outside protected areas. Here they face a suite of threats that could limit the pool of birds available to recruit into the park.

Even more worrying, however, is the discovery that at least some adult birds, which were assumed to be more sedentary than immatures, also travel considerable distances and frequently venture beyond Kruger. Many of these mobile adults are presumably 'floaters', birds waiting for a territory to fall vacant. For instance, one adult female ranged far into Mozambique, where she was killed.

Sadly, this was not an isolated incident. In April 2016, a 4.6-kilogram female martial eagle was fitted with a GPS tag in Kruger Park. Her capture and the attachment of the tracking device were recorded by a film crew documenting the study for a British television programme, narrated by well-known TV presenter Steve Backshall. A few weeks later, the bird ventured into Mozambique, and shortly afterwards, her signal stopped moving, 160 kilometres from where she had been tagged.

Van Eeden and a colleague set off to the bird's last known location, in a remote corner of Mozambique, currently in the midst of renewed civil unrest. They battled through dense bushveld, in an area with few roads. Eventually, an hour-long walk into the bush led them to a small game trail, where – after searching through the long grass – they found the remains of the eagle. Its tail was sticking up between two bushes, and its neck was trapped

in a snare that had probably been set to catch small antelope. Most people in the small villages in the area rely on cattle herding, subsistence farming and hunting to survive.

The death of a second adult martial eagle from Kruger in rural communities in Mozambique is cause for grave concern, especially as only eight adults have been tagged with GPS transmitters. Without GPS tracking, this cause of mortality would go undetected.

A healthy population relies on having adults available, to occupy vacancies created by the deaths of breeding birds or to challenge ageing territory holders. A large number of non-breeding adults probably signals a relatively stable population. We don't know enough about the population structure of martial eagles in Kruger, but the unnatural deaths of adult floaters may be even more important in terms of affecting population dynamics than the mortality of immature birds.

The findings confirm that even the largest protected areas may be insufficient to conserve wide-ranging predators; and that conservation efforts to safeguard them are needed beyond park boundaries. 

By the Percy FitzPatrick Institute of African Ornithology, originally published in [African Birdlife](#). Image by [Bernard Dupont](#), Wikimedia Commons.





Partnerships for the goals

SDG 17: Revitalise the global partnership for sustainable development

Why global partnerships matter

The sustainable development goals (SDGs) are wide-ranging and focus on the world's most intractable problems. The United Nations (UN) recognises that the goals cannot be met by people working in silos, and have included 'partnerships' as the 17th goal. One of the specific targets is to "Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms." **Danie Visser assesses what should be done to achieve this.**

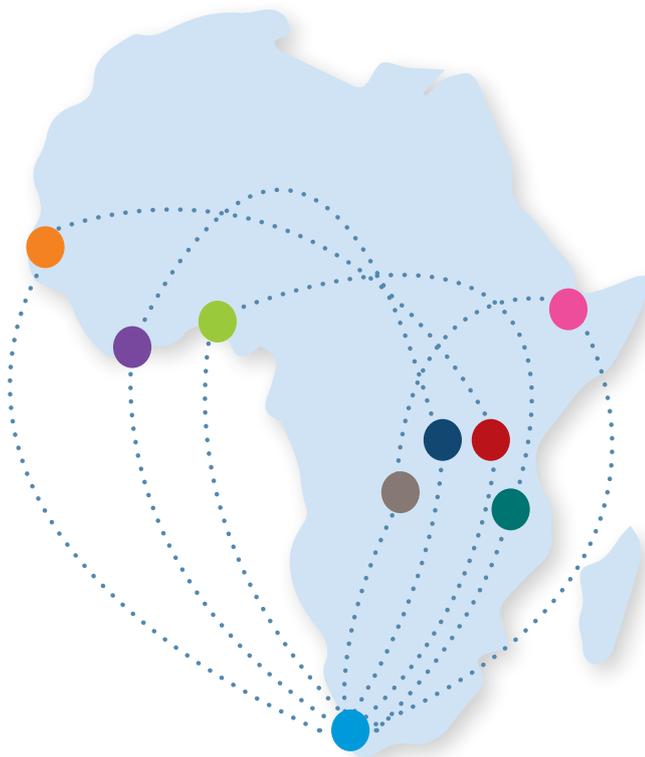
There are arguments that internationalisation – because of the domination of the global north, and a perceived relative disinterest in Africa – is another form of colonisation; Africa, it has been argued, should remove itself from the international stage and develop its own intellectual strengths and identities. Attempts by African institutions to become global institutions, argues Hawawini, "may divert them from their fundamental mission to educate their home-based students and help them become effective global citizens".

There is, of course, an opposing view: Teferra argues, for instance, that Africa's higher education system

suffers considerably from being the least internationally engaged in the world: "it relies heavily on the discourse, paradigms and parameters set by others, rendering it vulnerable to global whims".

Similarly, Connell has argued strongly that mainstream social science presents a picture of the world that is heavily dominated by the educated and affluent in Europe and North America. She cites, for instance, Giddens' reading list at the end of *Runaway World* – subtitled 'how globalisation is shaping our lives' – in which every one of the 51 books is published in the 'metropole' – urban and cultural centres of the global north.

AFRICAN RESEARCH UNIVERSITIES ALLIANCE (ARUA)



ARUA, a partnership of research universities in Africa, was launched in early 2015 as a response to the growing challenges faced by African universities. The alliance will form a hub that supports centres of excellence in many other universities across the continent. The focus is on building indigenous research excellence to enable the continent to take control of its future and assert itself as a powerful global force.

ARUA universities

- Ghana University of Ghana
- Ethiopia Addis Ababa University
- Kenya | University of Nairobi
- Nigeria University of Lagos
University of Ibadan
Obafemi Awolowo University
- Rwanda University of Rwanda
- Senegal Université Cheikh Anta Diop
- South Africa University of Cape Town
University of KwaZulu-Natal
University of Pretoria
Rhodes University
Stellenbosch University | University of the Witwatersrand
- Tanzania University of Dar es Salaam
- Uganda Makerere University

This is, perhaps, one of the strongest arguments for internationalisation. Decolonisation of the curriculum is a hot topic at the moment in South African universities. At research-intensive universities, the best teaching is fed and watered by the best research, so decolonisation of the curriculum depends on the development of African-centred knowledge. This knowledge, in turn, needs to feed into global debates.

To do this, however, we need a different pattern of collaboration. A [Nature Index](#) supplement on global scientific collaborations shows that African universities most frequently collaborate with universities outside of Africa. We need to change this. To become a strong presence in the international intellectual arena and influence global debates, we need to strengthen collaborations *within* Africa – which, in turn, will strengthen the African voice as a whole.

The African Research Universities Alliance is a network created in 2015 as part of an attempt to tackle this challenge. A partnership of 16 research universities across nine African countries, its focus is to build research excellence and to boost research capacity, so that we can address transnational public policy and development strategies. This will enable the continent to take control of its future and develop a more assertive voice, which, in turn, will enable us to assert African research as a powerful global force.



We should build our partnerships in such a way that our collaborations with the global north bring African priorities into the research agenda. An excellent example of this is the Investigation of the Management of Pericarditis (IMPI) trial that established for the first time whether the prescription of steroids to patients with TB pericarditis – a dangerous form of TB that can cause fluid build-up and compression of the heart, and kills a quarter of those who contract it – are effective. Until then, prescription of steroids depended on whether

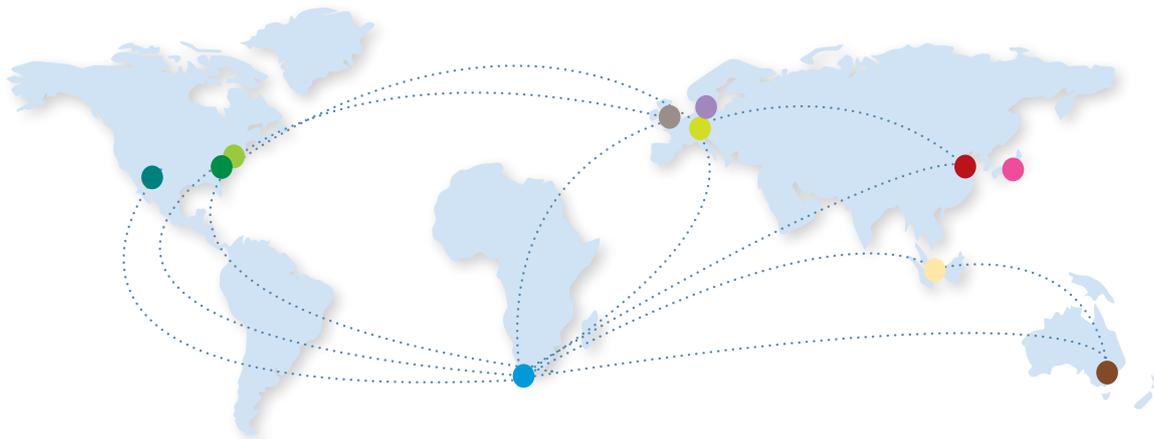


WORLDWIDE UNIVERSITIES NETWORK (WUN)

The Worldwide Universities Network (WUN) is a leading global higher education and research network made up of 19 universities across the globe. Together they work to drive international research collaboration and address issues of global significance. WUN is the most active global higher education and research network, with 90 active research initiatives, engaging over 2 000 researchers and students collaborating on a diverse range of projects.

WUN universities

- | | | |
|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|  Maastricht University |  University of Bristol |  University of Sheffield |
|  Chinese University of Hong Kong |  University of Cape Town |  University of Southampton |
|  University of Alberta |  University of Ghana |  University of Sydney |
|  University of Auckland |  University of Leeds |  University of Western Australia |
|  University of Basel |  University of Massachusetts, Amherst |  University of York |
|  University of Bergen |  University of Rochester |  Zhejiang University |



INTERNATIONAL ALLIANCE OF RESEARCH UNIVERSITIES (IARU)

The International Alliance of Research Universities (IARU), established in 2006, is a network of 11 international research-intensive universities from nine countries across the globe. IARU members work together to address the major challenges of our time, providing opportunities to students and staff and promoting joint projects at various levels between member universities.

IARU universities

- Australian National University
- University of California, Berkeley
- University of Oxford
- ETH Zurich
- University of Cambridge
- University of Tokyo
- National University of Singapore
- University of Cape Town
- Yale University
- Peking University
- University of Copenhagen

the specialist treating the condition believed in them or not. But it is not a pressing issue in the global north, where TB pericarditis is a relatively rare condition. It took a South African – Professor Bongani Mayosi, dean of the Faculty of Health Sciences – to put the issue on the table, and institutions from seven African countries teamed up in an effort to solve the problem. Halfway through the trial, the Canadian Institutes of Health Research stepped in, which allowed them to leverage further funding and complete the trial.

Building three-way partnerships between UCT, a partner in the global north and another from the global south has become a successful strategy for us that could work equally well for others. Such trilateral partnerships – specifically mentioned in the targets of SDG 17 – can take a bit of midwifery to set up, but they repay the effort with dividends. For instance, in climate adaptation research, UCT is leading research projects collaborating with African research partners

such as the universities of Namibia, Botswana, Ghana and Addis Ababa, as well as with overseas research institutes including the University of East Anglia, University of Oxford, the UK Meteorological Office, the Swedish Meteorological and Hydrological Institute and California’s Lawrence Livermore National Laboratory. Each of these partners brings something unique and valuable. The African partners bring expertise and southern hemisphere perspectives on social and environmental issues, and provide opportunities for comparative case studies across the continent. The European and US partners bring state-of-the-art climate computing resources and expertise.

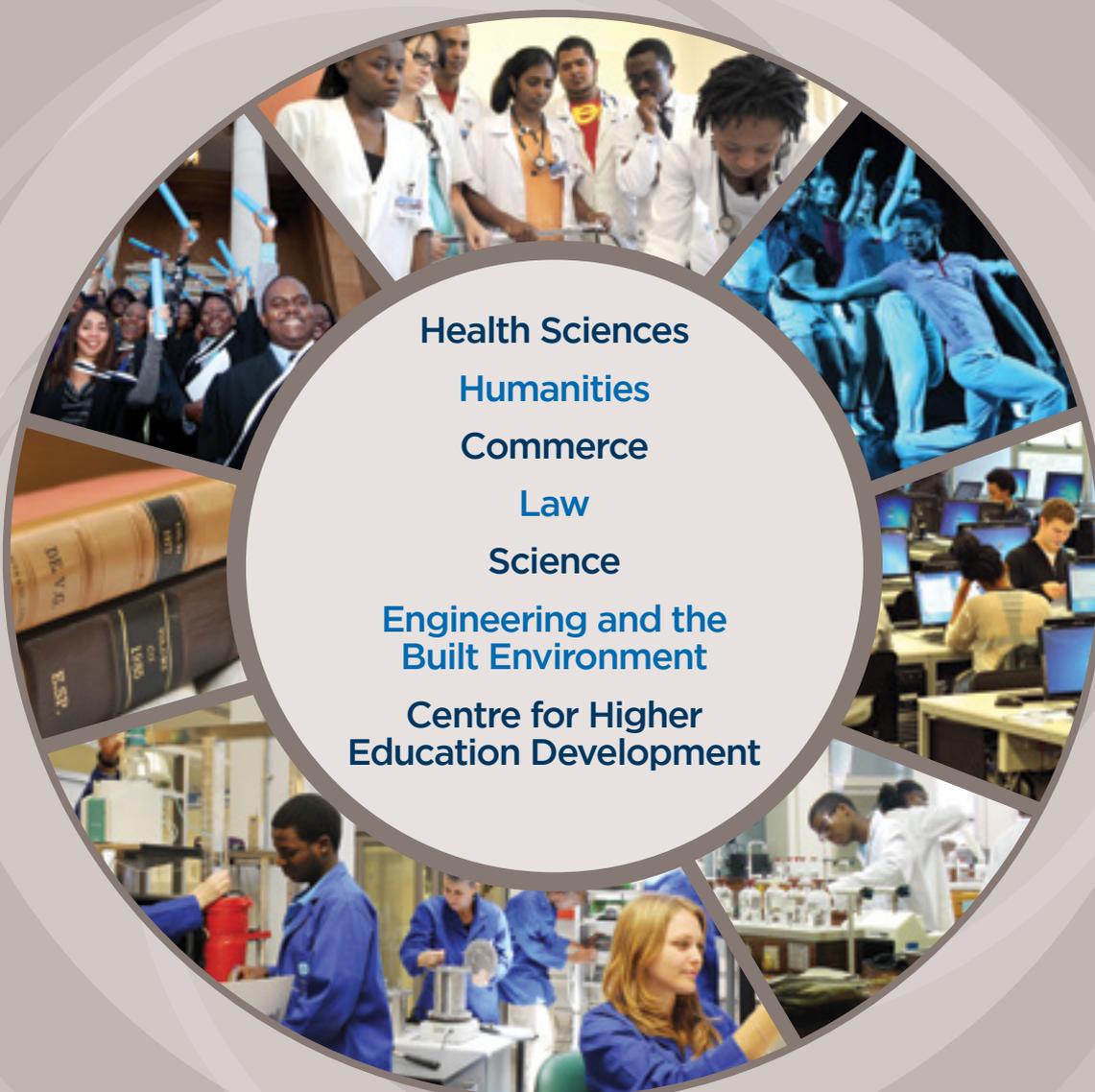
As with the IMPI trial, African investigators need to apply the best scientific methods to local problems, they need to collaborate with one another to achieve the scale required to answer these questions in a definitive manner, and link up with centres of excellence elsewhere in the world. ○



Building three-way partnerships between UCT, a partner in the global north and another from the global south has become a successful strategy.

Professor Danie Visser is the deputy vice-chancellor for research and internationalisation.

Faculty highlights



Health Sciences

Humanities

Commerce

Law

Science

**Engineering and the
Built Environment**

**Centre for Higher
Education Development**



Health Sciences

11

DST/NRF
SARChI
Chairs

New AWARDS

Prof Tania Douglas, in biomedical engineering and innovation, and **Prof Nonhlanhla Khumalo**, in dermatology and toxicology

Accredited
journal units

554

Up
5%
from previous
year

R764m

Income raised
by contracts

Up 12%
from previous
year

NRF ratings

135

11

A rated

NEW NRF A RATINGS since June 2015

Prof Bongani Mayosi

Internal AWARDS

UCT College Fellow status (**Profs Raj Ramesar, Gary Maartens, Bongani Mayosi, Valerie Mizrahi, Keertan Dheda**) and College of Fellows' Young Researcher Awards (**Drs Tolu Oni and Jonathan Peter**).

UCT Social Responsiveness award: Assoc Prof Roshan Galvaan, Liesl Peters (Occupational Therapy).

External AWARDS

South African Medical Research Council (SAMRC) Scientific Merit Awards: Gold – **Prof Gary Maartens** and **Prof Robert Wilkinson** (medicine), Silver – **Dr Jonathan Peter** (medicine), Platinum – **Prof Dan Stein** (psychiatry and mental health).

NRF Research Excellence Award for Emerging Researchers: **Dr Ntobeko Ntusi** (medicine).

S2A3 Gold South Africa Medal: **Prof Tim Noakes** (human biology).

Cancer Association of South Africa AG Oettlé Memorial Medal and International Agency for Research on Cancer Medal of Honour: **Prof Lynette Denny** (obstetrics and gynaecology).

Union Scientific Prize: **Dr Helen Cox** (pathology).

TW Kambule-NSTF Awards: 2014/2015 – **Prof Dan Stein** (psychiatry and mental health), **Prof Jennifer Jelsma** (health and rehabilitation), **Assoc Prof Grant Theron** (medicine); 2015/2016 – **Prof Crick Lund** (psychiatry and mental health), **Dr Tolu Oni** (public health), **Dr Sudesh Sivasu** (human biology).

HUGO Africa Award: **Prof Raj Ramesar** (pathology).

Royal Society of SA John FW Herschel Medal: **Emer Prof Robert Millar** (integrative biomedical sciences).

HIGHLIGHTS from June 2015 to June 2016

New leadership appointments

Prof Bongani Mayosi, dean of Health Sciences.

Prof Harsha Kathard, head of new Dept of Health Sciences Education.

Prof Carolyn Williamson and **Prof Ed Sturrock**, heads of Depts of Pathology and Integrative Biomedical Sciences (evolved from Dept of Clinical Laboratory Sciences).

Prof Karen Sliwa, director of the Hatter Institute, first woman World Heart Federation president-elect (also first from Africa).

Prof Lee Wallis, head of Emergency Medicine, first International Federation for Emergency Medicine President from Africa.

Prof Linda-Gail Bekker, CEO of the Desmond Tutu HIV Centre (DTHC), first African woman International AIDS Society president.

New initiatives

SA's first hair and skin research laboratory (with Groote Schuur Hospital).

[Cape Universities Body Imaging Centre \(CUBIC\)](#).

Significant research contributions

A study by **Dr Llewellyn Padayachy** (surgery), with a leading Norwegian research institute, advanced the current static imaging method.

Research from the Francis Crick Institute and UCT, led by Dr Max Gutierrez and **Prof Robert Wilkinson** (director, Clinical Infections Diseases Initiative) could explain why people can be treated for TB hiding outside the lungs, recover, then get it again.

POSTGRADUATES (end-2015)

1 354 Master's students

206 Master's graduates

463 PhD students

58 PhD graduates

Highest
number
yet in 1
academic
year

Prof Keertan Dheda (medicine) led evaluation of a rapid, low-cost, simple-to-use urine test for TB.

Three simple solutions to prevent heart attacks and stroke have been proven effective by an international team led by Hamilton researchers, with the SA component led by **Prof Karen Sliwa**.

Assoc Prof Mark Hatherill and **Assoc Prof Tom Scriba** (director and deputy director, SA Tuberculosis Vaccine Initiative (SATVI)) published work on TB vaccines for healthcare workers. SATVI also reported discovery of a TB blood test long before the disease manifests.

Dr Musaed Abrahams (Faculty MBChB graduate) and collaborators developed an application to assist healthcare workers guide antiretroviral treatment

Prof Linda-Gail Bekker (CEO, DTHC) and colleagues contributed to multi-country trials on dapivirine vaginal microbicide rings for preventing HIV infection.

Major research grants

UCT and the University of Washington received a Bill and Melinda Gates Foundation grant to test a low-cost, simpler method of diagnosing TB.

Assoc Prof Jennifer Moodley (Cancer Research Initiative Director), **Prof Iqbal Parker** (integrative biomedical sciences) and **Prof Bongani Mayosi** (medicine) received international Newton Fund grants via the SAMRC.

Prof Lynnette Denny (head, obstetrics and gynaecology) received a SAMRC Clinical Cancer Research Centre grant and **Prof Heather Zar** (head, paediatrics and child health) a SAMRC Extramural Research Unit.

UCT received 10 National Institute of Health-MRC US-South Africa Programme for Collaborative Biomedical Research grants (**Prof Carolyn Williamson**, **Assoc Prof Helen McIlleron**, **Prof Janet Hapgood**, **Assoc Prof Christopher Colvin**, **Dr Jo-Ann Passmore**, **Dr Catherine Riou**, **Assoc Prof Digby Warner**, **Prof Clive Gray**, **Assoc Prof Elmi Muller** and **Prof Robert Wilkinson**).

New UCT-accredited research groupings:

Kidney Disease and Hypertension Research Unit (**Prof Brian Rayner**).

Neurosciences Institute (**Prof Graham Fieggen**).

MRC/UCT Unit on Child and Adolescent Health (**Prof Heather Zar**).

117 POSTDOCS
(end-2015)

Up from
108
in 2014

Humanities

4

DST/NRF
SARCHI
Chairs

Accredited
journal units

170.2

R48.4m

Income raised
by contracts

Increase in foreign funding

from foreign universities

from foreign universities

2014

2015

R1 897 804

R12 393 531

2014

2015

R23 996

R1 127 773

NRF ratings

86

5

A rated

Internal AWARDS

Dean's Awards for Teaching Excellence for 2015: **Dr Bodhisattva Kar** (historical studies), **Dr Christopher Ouma** (english language and literature) and **Dr Shose Kessi** (psychology).

Distinguished Teacher Award: **Dr Joanne Hardman** (School of Education) and **Dr Azila Reisenberger** (School of Languages and Literatures).

2015 UCT Book Award: **Assoc Prof Sa'diyya Shaikh** (Dept of Religious Studies) for *Sufi Narratives of Intimacy*.

2016 UCT Book Award: **Dr Litheko Modisane** (Centre for Film and Media Studies) for *South Africa's Renegade Reels: the making and public lives of black-centred films*.

External AWARDS

Prof Xolela Mangcu: Harry Oppenheimer Fellowship Award; he will use his research grant to write a new biography of former president Nelson Mandela. He takes up the fellowship at Harvard University for the 2016/2017 academic year.

Mecodem Project - **Prof Herman Wasserman, Dr Tanja Bosch and Assoc Prof Wallace Chuma** form the South African team of the Media, Conflict and Democratisation project funded by the European Union, a multi-country study.

Centre for African Studies/College of Music Mellon Funded Project 'Re-Centring Afro-Asia: Musical and Human Migrations in the Pre-Colonial Period', directed by **Prof Ari Sitas**, in collaboration with **Prof Ntsebeza** and others.

HIGHLIGHTS from June 2015 to June 2016

New leadership appointments

Roger Gachago was appointed in 2016 to the role of humanities IT manager – a position previously occupied by Puleng Makhoalibe.

Prof Harry Garuba: head of Dept of the School of African and Gender Studies, Anthropology and Linguistics (AXL) and acting deputy dean (research and postgraduate affairs) for a period of one year.

Prof Jane Bennett: head of the Dept for English Language and Literature.

Assoc Prof Sa'diyya Shaikh: head of the Dept for Religious Studies.

New initiatives

The Institute for the Creative Arts (ICA), formerly the Gordon Institute for Performing and Creative Arts (GIPCA), was launched on 5 April 2016.

UCT English Language Centre: opened its doors to the first cohort of students in October 2015. This is one of only two language centres located within a South African university; it will support the university's internationalisation agenda.

The initiative, which is aimed primarily at the Asian and Northern European markets, signals a new approach to language training at UCT. For the first time, the humanities will offer a selection of year-round courses in general english (beginner to advanced levels); business english; and exam preparation for the IELTS, TOEFL and Cambridge FCE and CAE exams to the international community.

Significant research contributions

Assoc Prof Horman Chitonge published two monographs.

Major research grants

Mellon Funding: Humanities Professoriate was established in 2015 to provide targeted/strategic support to black (female and male) staff members in the Faculty of Humanities, so that they can meet specific career development criteria and/or to produce research outputs that will impact in a significantly positive manner on their career development. The programme seeks to increase the representation of black academic staff members in more senior academic positions.

Mellon Funding: The ICA established a Graduate Programme in Interdisciplinary and Public Arts (MA and PhD), offering Mellon scholarships and fellowships to emerging artists (through Mellon Funding).

Mellon Funding received for the Centre for Curating the Archive 'Other Histories' project (three-year grant). Funding enables workshops, exhibitions and the appointment of post-doctoral fellowships.

Research groupings highlights

In its second year, the Queer in Africa symposium was co-hosted by UCT's Institute for Humanities in Africa (HUMA), the Human Science Research Council (HSRC), and the University of Huddersfield; and supported by the Heinrich Boell Foundation. The two-day symposium brought together 15 scholars and activists from Namibia, DRC, South Africa, Nigeria, Uganda and the UK.

POSTGRADUATES (end-2015)

627 Master's students

215 Master's graduates

260 PhD students

48 PhD graduates

Highest
number

PhD graduates yet
in one academic
year

34 POSTDOCS
(end-2015)

Commerce

2

**DST/NRF
SARChI
Chairs**

**Accredited
journal units**

100
(from 79
in 2014)

2014 - 2015

28%
increase

R89.5m

**Income raised
by contracts**

Highest
research
contracts
from SA
universities

2nd highest
from foreign
non-profit
organisations

NRF ratings

40

2

A rated

External **AWARDS**

DataFirst won an Economic and Social Research Council (ESRC) National Research Foundation (NRF) international collaboration award with the UK Data Archive, a multi-institution research project on household energy data.

Prof Ingrid Woolard was awarded the Alan Pifer Research Award for 2015, in recognition of her research relevant to the advancement and welfare of South Africa's disadvantaged people.

Prof Ulrike Rivett (information systems) won the best Water Research Commission (WRC-SA) research project award.

Adv Kerri Brick (Environmental Policy Research Unit) received the award for Best PhD Thesis at the Economic Science Foundation conference.

Kate James (finance and tax) won the (Honours) Norton Rose Fulbright/SAIPA Tax Thesis Competition and **Timothy Bland** (finance and tax) the UCT-IBFD Prize for International Tax.

Several of the PhD students in the Dept of Information Systems received NRF Innovation Awards, two UCT doctoral packages, two CSIR awards, World Bank, and Schlumberger awards.

HIGHLIGHTS from June 2015 to June 2016

New leadership appointments

Two South African Labour Development Research Unit (SALDRU) associates were asked to play broader national and international roles based on their research strengths and extensive policy commitments.

Dr Cecil Mlatsheni was appointed by the Minister of Labour to the Employment Conditions Commission.

Prof Ingrid Woolard was appointed to work on the eminent International Panel on Social Progress.

In 2015, **Prof Haroon Bhorat** (director of the Development Policy Research Unit) was invited to be: non-resident senior fellow at the Brookings Institution, director on the Board of the Western Cape Tourism, Trade and Investment Promotion Agency (WESGRO), research fellow at the Institute for the Study of Labour (IZA), a member of the United Nations, World Health Organisation's High Level Commission on Health Employment and Economic Growth and advisor on the South African Parliament's High Level Panel on acceleration of change and transformation.

Prof Murray Leibbrandt, director of SALDRU, was elected a member of the Academy of Science of South Africa (ASSAf).

Assoc Prof Kanshukan Rajaratnam (finance and tax) was inaugurated into the South African Young Academy of Sciences.

Assoc Prof Ilse Lubbe (College of Accounting) has been appointed deputy editor of the SA Journal of Accounting Research.

General highlights

The School of Management Studies hosted an international conference at UCT, with participants from 30 countries.

POSTGRADUATES (end-2015)

417 Master's students

150 Master's graduates

209 PhD students

21 PhD graduates

Post-graduate enrolment increased – from 1 888 (2014) to 2 921 (2015), of whom 591 were international students

An all-time record high PhD graduates

The School of Economics hosted the International Network for Economic Methodology conference.

CITANDA hosts the extension of a €3+million project to research and develop an Enterprise System education programme for the African continent.

The African Collaboration for Quantitative Finance and Risk Research Unit (ACQuFRR) co-hosted the financial mathematics team challenge with the University College London.

The Centre for Information Technology and National Development in Africa (CITANDA) hosted two international conferences in 2015.

The Research Unit in Behavioural Economics and Neuroeconomics (RUBEN) conducted field surveys and experiments with 10 000 Danish gamblers and a large sample of students from the USA.

The College of Accounting introduced a BCom (Hons) with a research component.

A new project on Special Tax Zones was initiated by the tax department, in collaboration with the International Bureau for Fiscal Documentation. Academics in the tax dept participated in the Marie Curie International Staff Exchange Scheme (IRSES).

The fieldwork for the fourth wave of National Income Dynamics Study (NIDS) was completed in 2015.

In 2015, SALDRU researchers trained more than 100 non-UCT South African graduate students, faculty members and policy researchers in the use of the NIDS data for policy analysis.

The Environment Policy Research Unit (EPRU) received over R5 million from the Swedish International Development Cooperation Agency, Environment for Development and the NRF.

Dr Andre Hofmeyr and **Prof Harold Kincaid** from RUBEN were awarded R670 000 from the NRF to explore the behavioural determinants of cigarette smoking.

The Centre for Actuarial Research, CITANDA & EPRU had their accreditations renewed for a further period of five years.

Two new interdisciplinary and cross-faculty research groupings were also established. These are: the UCT Tax Institute for Fiscal Research; and the Data for Development Institute.

10 POSTDOCS
(end-2015)

Law

3

DST/NRF
SARChI
Chairs

Accredited
journal units

72

R30.42m

Income raised
by contracts

Increase of
more than
2x
since 2013

2013
R11 310 000
47 contracts

NRF ratings

18

1

A rated

Internal AWARDS

Prof Hanri Mostert won the UCT Meritorious Book Award for *Mineral Law: principles and policy in perspective*.

External AWARDS

Prof Hugh Corder directed a project on the appointment of judges in six Commonwealth countries, funded by the Claude Leon Foundation. Outputs include a book and guidelines for judicial appointments.

The DST/NRF SARChI Chair: Mineral Law in Africa was awarded to **Prof Hanri Mostert**.

The DST/NRF SARChI Chair in Customary Law, Indigenous Values and Human Rights, held by **Prof Chuma Himonga**, was renewed. Prof Himonga also published *Reform of Customary Marriage, Divorce and Succession in South Africa: living customary law and social realities*.

The Democratic Governance Research Unit received support from the Norwegian embassy for a project on Women Pioneers in Law.

The Centre for Law and Society (CLS) received a substantial grant from the Constitutionalism Fund to support research and dialogue on critical issues in South African law and society.

The IP Unit secured a follow-up grant of R14 million for the next three-year phase of their Open AIR project.

HIGHLIGHTS from June 2015 to June 2016

Prof Dee Smythe was appointed director of research.

The new phase of the Open African Innovation Research (**Open AIR**) project commenced in 2015. It seeks to solve a problem at the heart of innovation policy and practice: how to reconcile tensions between knowledge appropriation and access, between excluding and sharing, and between competing and collaboration. In doing so, the project helps in addressing some of the most significant innovation challenges: to promote population health, environmental sustainability, universal education, cultural participation, food security, poverty alleviation and economic growth.

The Centre of Criminology has been involved in the police-led process of implementing the Khayelitsha Commission of Inquiry recommendations.

The Tax Institute for Fiscal Research was established, a result of collaboration between the faculties of law and commerce, in cooperation with the International Bureau of Fiscal Documentation. The institute's aim is to be Africa's leading academic research institute in fiscal matters.

The Rural Women's Action Research Unit, formerly part of the Centre for Law and Society, and now reconstituted as the Land and Accountability Research Centre (LARC), has received a range of grants to support work on rural democracy and governance, including from the Raith Foundation, Claude Leon and Ford, and the Tshemba Foundation. Renewed grants were welcomed from the Millenium Trust, HBS and the Open Society Foundation, in respect of supporting strategic litigation.

The Ford Foundation is supporting **Dr Kelley Moul**'s work in nine countries on forced and child marriage.

Prof Pierre de Vos, faculty SR representative, received a R30 000 grant from the Academic and Non-Fiction Authors' Association of South Africa (ANFASA) for an ongoing project on autobiography and the Constitution.

Assoc Prof Alistair Price edited *A Transformative Justice: essays in honour of Pius Langa* with Advocate Michael Bishop.

Prof Dee Smythe published *Rape Unresolved: policing sexual offences in South Africa*.

The Institute for Development and Labour Law published *Laws Against Strikes: the South African experience in an international and comparative perspective*, edited by **Prof Rochelle Le Roux** with Sir Bob Hepple and Prof Silvana Sciarra.

Ms Lee-Ann Tong and **Prof Caroline Ncube** edited the third issue of the *SA Intellectual Property Journal*.

Dr Hannah Woolaver was awarded a research grant of \$250,000 AUD from the Australian Research Council for a three-year research project in collaboration with Assoc Prof Sarah Williams of the Faculty of Law, University of New South Wales. The project, 'Evaluating Civil Society Participation before International Criminal Tribunals', provides the first comprehensive assessment of the methods by which civil society actors seek to intervene in international criminal tribunals and the influence of those interventions on legal outcomes, including the question of whether those interventions reflect the range of civil society interests in international criminal justice, or are limited to 'Western' perspectives.

DST/NRF SARCHI Chair in Justice and Security **Prof Mark Shaw** published the book *A Citizen's Guide to Crime Trends* with **Anie Kriegler**.

The Centre for Criminology completed a major study for the United Nations on international illicit flows and urban security.

POSTGRADUATES (end-2015)

157 Master's students

95 Master's graduates

75 PhD students

11 PhD graduates

1 POSTDOC
(end-2015)

Science



12

DST/NRF
SARChI
Chairs

Accredited
journal units

351

R159m

Income raised
by contracts

47%

Increase in rand value of contracts in 2015 over 2014, via 307 contracts from government and non-government sources, local and foreign

NRF ratings

171

7

P rated

19

A rated

NEW NRF A RATINGS since June 2015

Prof Bruce Hewitson
Prof Chris Reason
Prof Anusuya Chinsamy-Turan

Internal AWARDS

Prof Renée Kraan-Korteweg, from the Department of Astronomy, was named as one of six new UCT Fellows.

External AWARDS

Prof Michael Feast, Lifetime Achievement Award from NRF.

Assoc Prof Gina Ziervogel, a senior lecturer in the Department of Environmental and Geographical Science, and a research fellow in the African Climate and Development Initiative, won the Distinguished Young Women Researcher Award at the Women in Science Awards 2015.

Prof Peter Dunsby, Department of Mathematics and Applied Mathematics, was awarded the 2015/16 NSTF Award for research capacity development over the last five to 10 years.

Dr Robyn Pickering, a newly appointed lecturer in the Department of Geological Sciences, was awarded a P rating by the NRF, one of only 12 awards across the country.

Emer Prof Jennifer Thomson, Department of Molecular and Cell Biology, was recently awarded a global Lifetime Achievement Award for Women in Science, by the United Nations Environment Programme (UNEP).

Emer Prof George Ellis, Department of Mathematics and Applied Mathematics, has been elected Doctor Honoris Causa by the Pierre and Marie Curie University in Paris. He will also receive an honorary degree from the University of the Witwatersrand.

HIGHLIGHTS from June 2015 to June 2016

New leadership appointments

Prof Jill Farrant, Department of Molecular and Cell Biology, new DST/NRF SARChI Chair, who was awarded a chair in systems biology studies on plant desiccation tolerance for food security.

Assoc Prof Amanda Weltman, Department of Mathematics and Applied Mathematics, new DST/NRF SARChI Chair, who was awarded a chair in physical cosmology.

New initiatives

Establishment of the URC-accredited Human Evolution Research Institute (HERI), under the directorship of **Assoc Prof Rebecca Ackermann**, Department of Archaeology.

Establishment of the URC-accredited interdisciplinary **Human-Wildlife Institute**, under the directorship of **Prof Justin O'Riain**, Department of Biological Sciences.

Significant research contributions

The Department of Agriculture, Forestry and Fisheries partnered with **Dr Serge Raemaekers**, from the Department of Environmental and Geographical Science, to launch a new fishing application called **Abalobi**.

Jeremy Midgley, Harry Bolus Professor of Botany, **Gary Bronner**, MSc student **Joseph White** and Steve Johnson (UKZN), have shown that, unexpectedly, free-ranging small mammals were integral to dispersal of *Ceratocaryum* nuts.

Dr Robyn Pickering of the Department of Geological Sciences. The million-year-old monkey:

new evidence confirms the antiquity of a fossil primate from the Dominican Republic.

Prof Michael Meadows and postgraduate students from the departments of Environmental and Geographical Science and Geological Sciences have been involved in a major collaborative research project called RAIN (Regional Archives for Integrated iNvestigations), which investigates terrestrial and marine environmental archives in South Africa.

Prof Nicola Illing, students **Stephen Schlebusch** and **Zoe Gill**, Department of Molecular and Cell Biology, and Dr Walter L Eckalbar provide new insights on limb development, based on a decade of research on bats.

Major research grants

Prof Bruce Hewitson (environmental and geographical science): R26 million

The project 'Future Resilience for African CiTies And Lands' (FRACTAL) is a large international consortium funded by the UK, for which Climate System Analysis Group is the lead partner.

Prof Ed Rybicki (molecular and cell biology): R12 million

The Biopharming Research Unit obtained funding of R12 million from the Technology Innovation Agency for a three-year project, with the CSIR and the University of Pretoria, on developing plant-made vaccines to similar RNA viruses causing bluetongue disease in sheep and African horse sickness in horses.

Prof Kelly Chibale (chemistry): R 6.8 million

This research grant was received from the Celgene Corporation for the development of optimised leads against tuberculosis.

Prof Kelly Chibale (chemistry): R23 million

This research grant from the Strategic Health Innovation Partnerships (SHIP) unit of the Medical Research Council is for development of optimised leads against malaria, TB and non-communicable diseases.

Prof Sue Parnell (environmental and geographical science): R8.9 million

This consortium grant to the Urban ARK project is to address vulnerability and hazard assessments, the root causes and historical trajectories of risk, governance and planning.

POSTGRADUATES (end-2015)

481 Master's students

142 Master's graduates

415 PhD students

63 PhD graduates

139 POSTDOCS
(end-2015)

Engineering and the Built Environment (EBE)

6

DST/NRF
SARChI
Chairs

Accredited
journal units

111

(highest since
2010)

R144m

Income raised
by contracts

10%
increase in
research
contracts

2014
495

2015
546

NRF ratings

55

1

P rated

2

A rated

NEW NRF A RATINGS since June 2015

Prof Gerald Nurick

Internal AWARDS

Dr Megan Becker - 2015 College of Fellows Young Researcher.

Dr Sebastian Skatulla and Dr Kirsten Corin were awarded the Claude Leon Merit Award for Early-Career Researchers.

Dr Abimbola Windapo received the EBE Research Award for being the most prolific publisher in EBE in 2014.

Prof Gerald Nurick received the EBE Professorial Research Award for showing the best-ranked research profile over a five-year research period.

External AWARDS

Prof Alison Lewis - Water Research Commission award in the category of New Products and Services for Economic Development.

Dr David Ikumi from the Department of Civil Engineering and **Dr Amir Patel** from the Department of Electrical Engineering are recipients of the Claude Leon Merit Award for Early-Career Researchers.

The [Radar Remote Sensing Group](#) won a Gold Award at the AVI Aerospace Convention during October 2015, for its work on 'green' sensors not requiring new spectrum for detecting aircraft.

HIGHLIGHTS from June 2015 to June 2016

New leadership appointments

Prof Alison Lewis was appointed as dean from 1 June 2015.

Prof Dee Bradshaw was appointed the Minerals Beneficiation DST/NRF SARCHI chair.

Prof Patricia Kooyman is the new DST/NRF SARCHI chair in Nano Materials for Catalysis.

New initiatives

Future Water Institute.

UCT-Nedbank Real Estate Research Unit.

Research groupings highlights

A team from the Industrial Computational Fluid Dynamics Research Group in the Department of Mechanical Engineering has broken the longstanding Class A [Water Rocket](#) World Altitude Record, by a massive 33%.

Prof Sue Harrison from the Department of Chemical Engineering, director of the Centre for Bioprocess Engineering Research, holds the DST/NRF SARCHI Chair in Bioprocess Engineering and is a finalist in two categories for the 2015/2016 NSTF Awards.

Dr Manya Mooya's book *Real Estate Valuation Theory: A critical appraisal* was published, only the second book to be published in the Department of Construction Economics and Management. It was published by Springer, an esteemed publisher in the scientific world.

Moses Kiliswa received the KEYS award for the best paper presentation at the Advances in Cement and Concrete Technology in Africa 2016 International Conference, which took place in Dar-es-Salaam, Tanzania.

Moses is a PhD candidate under the supervision of **Assoc Prof Hans Beushausen** of the Concrete Materials and Structural Integrity Research Unit in the Department of Civil Engineering.

Four EBE staff were finalists in the NSTF Awards:

- **Prof Harald Winkler**, Department of Mechanical Engineering: NSTF-GreenMatter Award.
- Lumkani Fire Detection Team, UCT: research leading to innovation.
- **Prof Ed Boje** from the Department of Electrical Engineering: research leading to innovation.
- **Dr Melinda Griffiths**, Department of Chemical Engineering: TW Kambule Awards: emerging researchers.

Adele Boadzo, a 2015 electrical engineering master's graduate, has been selected as a 2016 Mandela Washington Fellow. She completed her BSc in electrical engineering in 2010 and her MSc in 2015, under the supervision of **Dr Sunetra Chowdhury**.

HyPlat

South Africa is a step closer to realising the full potential of its enormous platinum reserves with the launch of a spin-off company, HyPlat, able to manufacture high-quality components for the international hydrogen fuel cell industry. Hydrogen fuel cells are a promising source of clean energy that can be used to provide off-the-grid power to rural schools, hospitals or to provide back-up power for telecommunication and data centres. A key component is platinum, which the country generally exports only as a raw material.

All this is set to change with the commercialisation of technology developed in the Department of Chemical Engineering and Mintek in Randburg under the umbrella of HySA Catalysis.

[HySA Catalysis](#) was set up as one of three centres of competence by Hydrogen South Africa (HySA), a flagship project of the Department of Science and Technology (DST) to add value to the estimated upwards of 80% of world reserves in platinum group metals that South Africa holds.

HySA has set itself an ambitious target of becoming a major player in sales of fuel cell materials and components by 2020, while an academic goal is to develop a knowledge pool of highly skilled South African scientists and engineers equipped to work in this sector.

POSTGRADUATES (end-2015)

976 Master's students

235 Master's graduates

250 PhD students

25 PhD graduates

30 POSTDOCS
(end-2015)



Centre for Higher Education Development (CHED)

Accredited
journal units

14

R6.6m

Income raised
by contracts

NRF ratings

9

External AWARDS

The Research on Open Educational Resources for Development (ROER4D) Project was awarded the Open Research Award for Open Education Excellence by the international Open Education Consortium.

Assoc Prof Mbulungeni Madiba, co-ordinator of the Multilingualism Education Project: Oppenheimer Memorial Trust Sabbatical Award; Visiting Research Fellowship at the University of Birmingham and the University College of London (SOAS).

Dr Finuala Dowling, senior lecturer in extra-mural studies: 2016 Herman Charles Bosman prize for English fiction, for her novel *The Fetch*, published by Kwela.

HIGHLIGHTS

from June 2015 to June 2016

Assoc Prof Suellen Shay has written six articles for the new media platform [The Conversation Africa](#), achieving over 45 000 reads.

New initiatives

Since February 2016, the faculty has employed two mentors (a retired senior scholar, and a professor on secondment) to support research capacity development for CHED researchers. Besides their mentoring duties, these scholars will be developing capacity within CHED to take research mentoring forward beyond these appointments.

Significant research contributions

Dr Arlene Archer, senior lecturer in the Language Development Group and Writing Centre co-ordinator, co-edited *Multimodality in Writing: the state of the art in theory, methodology and pedagogy*, published in June 2015.

Research groupings highlights

CHED conducts research to inform educational development practice, at institutional, national and international levels. The following research projects in CHED are responding to current, key challenges related to access and equity in higher education.

The ROER4D Project

(UCT Principal Investigator: **Assoc Prof Cheryl Hodgkinson-Williams**)

The ROER4D project is an International Development Research Centre-funded initiative hosted jointly by the Centre for Innovation in Learning and Teaching (CILT) at UCT and Wawasan Open University in Malaysia. The first of its kind in terms of global reach and research focus, the project aims to produce evidence-based research from 26 countries in South America, sub-Saharan Africa and South-east Asia on the adoption and impact of Open Educational Resources (OER) in the global south.

Of the 18 ROER4D sub-projects, three are hosted in CHED. The first is investigating the structural, cultural and motivational factors that shape academics' adoption of OER at three universities in South Africa. The second is focused on UCT's Massive Open Online Course (MOOC) project, and tracks the adoption of OER in and as MOOCs. A third project aims to develop an understanding of the funding allocation of government money into educational resource acquisition, development and dissemination in basic education in South Africa.

Next generation of extended curricula

(UCT Principal Investigator: **Assoc Prof Suellen Shay**)

In August 2013, the Council for Higher Education (CHE) released 'A proposal for undergraduate curriculum reform in South Africa: a case for a flexible curriculum structure' (CHE, 2013). The argument was that the current curriculum structures pose a systemic obstacle to access and success that can only be overcome through deliberate intervention at a systemic level. The proposal was not approved and higher education in South Africa finds itself in the precarious position of ambitious targets for growth in enrolments and graduation rates.

In 2014 and 2015, **Assoc Prof Suellen Shay**, along with a team of colleagues from the University of Johannesburg, the University of Fort Hare and the Cape Peninsula University of Technology launched a multi-institutional research and development project funded by the Department of Higher Education and Training Collaborative Teaching Development Grant, with the aim of understanding the strengths, limitations and overall effectiveness of the current extended curriculum programmes, and what reform is required to strengthen the contribution of these programmes to systemic reform.

First in the Family at University (FIFU) project

(UCT Principal Investigators: **Assoc Prof Moragh Paxton**, 2014 to 2015; **Dr Rosin Kelly-Laubscher**, January 2016 to the present)

The FIFU project is an international project involving six countries and funded by the Worldwide Universities Network (WUN). The project investigates the dynamic, complex experiences of systemically underserved students who are first in the family to attend university.

Decolonising the Humanities Curriculum

(Principal Investigator: **Assoc Prof Kathy Luckett**)

The Decolonising the Humanities Curriculum project is located in the Humanities Education Development Unit, and is funded by the NRF. The focus of this project is:

- Analysing what kinds of knowledge the humanities deal with;
- Excavating the epistemes that have shaped the colonial canon to date; and
- Investigating possibilities for integrating subjugated knowledges, languages and cultures into the formal undergraduate curricula.

The challenges of equity and access: the higher education curriculum answers back

(UCT Principal Investigators: **Assoc Prof Jeff Jawitz** and **Assoc Prof Lucia Thesen**)

This is a WUN research project that examines the complex dynamics of higher education (HE) curricula in response to the global challenge of increasing access to, and equity in, HE. What is distinctive about the project is that, while much of the current HE effort focuses on undergraduate curriculum renewal, this research interrogates two underexplored curriculum domains: doctoral education, and the professional learning of academics.

By bringing together the distinct local histories and manifestations of the partner universities across Australia (University of Sydney), Aotearoa/New Zealand (University of Auckland), England (Bristol University) and South Africa (UCT), the project offers fresh insight and analysis into how access and equity are shaping the form and nature of curricula, as well as the identities and subjectivities of participants involved.

At UCT, we are focusing on two programmes – the New Academic Practitioner Programme (NAPP) and the Mellon Mays Undergraduate Fellowship – both of which foreground academic identity and social justice. The case studies will form the basis of various academic engagements designed to stimulate discussion.

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With special thanks to our researchers and other staff members who contributed stories and images to this report.

See a full list of our **research outputs**, including publications.

Keep up to date with the latest **research and innovation** news and features.

See the latest **UCT** news and events.

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