

NEWS LETTER

2019/2020

COVID-19: DSI RESPONSE

Data-Science Potential

**NIXTAMALIZATION ADDS
VALUE**

Protecting whistle-blowers

Making $\left\langle \begin{array}{c} \text{sure} \\ \text{it's} \\ \text{possible} \end{array} \right\rangle$



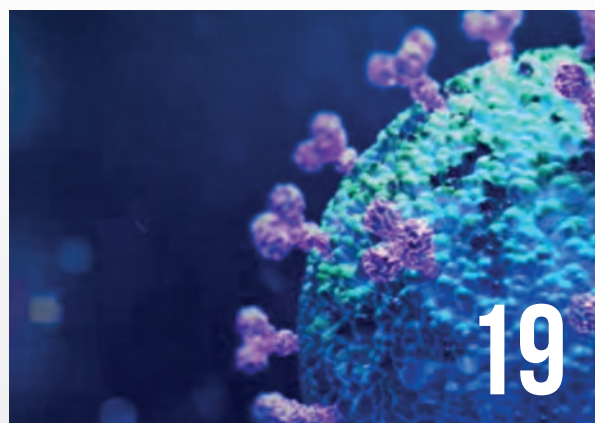
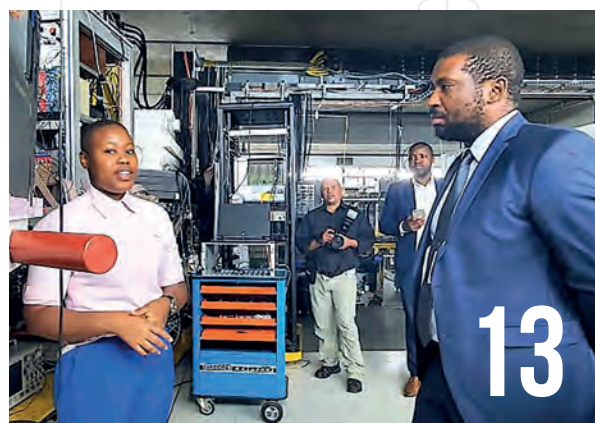
science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



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RESEARCH NEEDED into COVID-19 in South Africa

As government tackles the COVID-19 pandemic through a comprehensive approach to control the spread of the disease, the Department of Science and Innovation (DSI) has redirected R4 million from some of its projects to research into the novel corona virus.

With research and development at the heart of its work, the Department is supporting local research that will focus on surveillance, therapeutics and understanding the local epidemiology and natural history of the virus, which has infected in South Africa 62 people so far.

Given the rapid spread of the virus, and government's commitment to containing it, President Cyril Ramaphosa has declared the outbreak a national disaster and established a National Command Council comprising several ministries that will meet three times a week. An interministerial sub-committee has been established to coordinate a national framework for research on COVID-19.

The Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, is part of the interministerial panel tasked with implementing protocols planned to curb the spread of the virus. Addressing the media yesterday, the panel outlined their plans to tackle the outbreak.

Dr Nzimande said the DSI would make R4 million available to some interventions and will be costing the rest and mobilising



The DSI has redirected millions of rand to assist with research efforts.

for additional funds. "Through the DSI, we are engaging with the Department of Health, the Medical Research Council, and the South African Health Products Regulatory Authority with a view to mobilising funding, reprioritising research strategies and creating an enabling ethical and regulatory framework to facilitate research on the COVID-19 virus.

"Given the recent emergence of COVID-19 at a global level and the concomitant lack of adequate information on the epidemiology, therapeutic management or natural history of COVID-19 or vaccine availability, it is important for researchers in South Africa to coordinate a response to the outbreak to facilitate its control," said Dr Nzimande.

In Africa, the natural history of COVID-19 has not been established and the risk factors for transmission and clinical outcome are unknown.

"Thus, there is an urgent need to describe the epidemiology of COVID-19 in our country, as well as to address diagnostic, therapeutic, host and viral factors that may facilitate transmission or protect against infection," said the Minister.

– Making sure it's possible –



Minister of Higher Education, Science and Technology, Dr Blade Nzimande detailed the DSI's response response to the COVID-19 outbreak.

Globally the disease has already infected over 160 000 people in more than 150 countries, territories and regions, and resulted in thousands of deaths, mainly among the elderly.

Currently, it appears that there is very low mortality in children under nine years of age. Global deaths from the virus so far are highest in older men, smokers and people with underlying lung and immune disorders.

Government is particularly concerned that South Africa, with its high HIV and TB burden, may face a protracted coronavirus outbreak if these conditions cause prolonged viral shedding.

The DSI is looking at making further funds available for research, including research with a focus on the World Health Organisation's common protocol. Research topics to be considered for funding include diagnostic tests, targeted surveillance to establish risk factors among frontline staff at airports, trials for the therapeutic and prophylactic treatment of health care workers, the identification of antibodies in patients in South Africa who have successfully cleared the infection, and vaccine development.

Strategies for the management of mild, moderate and severe COVID-19 infections will be considered and prioritised for further development, costing and implementation. The regulatory and ethics research agenda will include the review and approval of ethical and regulatory challenges pertaining to clinical research.

"We are also going to prioritise surveillance strategies with a view to funding the top priorities," said Dr Nzimande.

The DSI, with its extensive portfolio of international cooperation instruments, will also facilitate South Africa's participation in international research and innovation to support the fight against COVID-19. Infectious disease

researchers at Austin's University of Texas studying the coronavirus (a team of scientists from the United States, France, China and Hong Kong) were able to identify the speed at which the virus can spread, a factor that may help public health officials in their efforts at containment. They found that time between cases in a chain of transmission is less than a week and that more than 10% of patients are infected by somebody who has the virus but does not yet have symptoms.

Their study, in press with the journal Emerging Infectious Diseases, is among the first to estimate the rate of asymptomatic transmission. It relates to the calculation of what is called the serial interval of the virus. To measure the serial interval, scientists look at the time it takes for symptoms to appear in two people with the virus – the person who infects another, and the second infected person.

Researchers found that the average serial interval for the coronavirus in China was approximately four days.

The speed of an epidemic depends on two things – how many people each case infects and how long it takes for infection between people to spread. The first quantity is called the reproduction number; the second is the serial interval. The short serial interval of COVID-19 means emerging outbreaks will grow quickly and could be difficult to stop, the researchers said. ■

Department of Science and Innovation supports South Africa's first rural community-owned Internet service provider

The Minister of Higher Education, Science and Technology, Dr Blade Nzimande, visited the remote Mankosi Village, 60 km from Mthatha, in the Eastern Cape on Thursday, 5 March to see a local innovation that has changed the lives of the area's rural residents by giving them access to the Internet.

Accompanied by the Minister of Minister of Communications and Digital Technologies, Stella Ndabeni-Abrahams, the project has been running successfully with the community having access to affordable solar-powered, Wi-Fi telecommunication networks since 2012.

Located in the mountainous region of the Eastern Cape, Mankosi is a small cluster of villages in Ward 26 of the Nyandeni Municipality. It has about 3 500 people, where the average income is about R388 per month. Most of the homes in the villages are not connected to the electricity grid and residents charge their cellphones at local shops. Some community members say they had to choose between buying basic food items and data, which is very expensive, particularly when your income is low.

But the Zenzeleni Community Networks project has brought some relief to residents. The project supported by the Department of Science and Innovation (DSI) in partnership with University of the Western Cape and implemented by the Technology Innovation Agency, is South-



Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, who addressed the rural Zenzeleni community, praised the project saying it was a model that could be replicated to other rural communities.

Africa's first cooperative-owned Internet service provider telecommunications network.

The project, which includes the Mankosi and Zithule cooperatives, was established using a social innovation model that provides communication networks to underserved rural communities. For R25 a user can enjoy unlimited Wi-Fi data valid for 32 days, with download speed of 2 048 Kbps.

The initiative is a bottom-up, citizen-driven socio-technical and economic project that aims to create open and neutral telecommunications network based on a common model. Community networks enable historically disadvantaged communities, many of which are in rural areas, to obtain the technical and related skills to install and manage their own electronic communications and infrastructure. This kind of community network enables historically disadvantaged communities, many of which are in rural areas, to obtain the technical and related skills to install and manage their own electronic communications and infrastructure.

Community networks further contribute to the empowerment of the marginalised population by fostering



The project is critical to residents of this remote Mankosi Village, located 60 km from Mthatha, in the Eastern Cape.

their local economy, creating employment, developing technical and entrepreneurial skills and contributing to the social cohesion of the communities they serve.

The Minister said this successful model could be replicated in other rural communities.

“By providing affordable connectivity in areas where there was none, or where it is not feasible for large telecommunications companies, community networks contribute to the empowerment of marginalised population by fostering the local economy, creating local employment and small, micro and medium enterprises, and contributing to the social cohesion of the community they serve.”

Dr Nzimande said that the DSI prioritised innovation at grassroots level.

“Technical and related skills, including support to install and operate their own communication services and infrastructure, were made available to the Zenzeleni Community Networks project, allowing communities to access a more reliable network at a cheaper price than the current market offerings,” said Dr Nzimande.

The University of the Western Cape played a huge role in sourcing the required technology and also trained the residents. The university’s Professor and Chair of Information Systems, Shaun Pather, said that South Africa has one of the lowest levels of household Internet access in the world.

“But the digital divide is about more than just universal access – especially in rural South Africa, where infrastructure is scarce and mobile networks can be prohibitively expensive. The digital divide is also about how ICTs facilitate social and economic outcomes amongst the poor. As such our goal in the Zenzeleni project is to catalyse the rural Digital Ecosystem.”

The professor added that the Zenzeleni project was about developing an innovative community-ownership model.

“This initiative addresses the true access gap in rural South Africa, as normal market forces have not addressed the rural divide.” To date, Zenzeleni Community Networks has connected three schools, three businesses, two non-government organisations and over 3 000 users. In the past two months alone, it has registered network traffic of 3 000 gigabytes. □

South Africa showcases DATA SCIENCE POTENTIAL

Ongoing investment by the Department of Science and Innovation (DSI) in data science continues to yield positive results, as more and more young people are trained to use it for the development of innovative solutions to socio-economic challenges.

The work of the Data Science for Impact and Decision Enhancement (DSIDE) programme gives students the opportunity to be mentored by experienced members of the data science community during their vacations.

The projects of the latest DSIDE participants were showcased at the DSI last week.

The DSIDE programme, funded by the DSI and hosted by the Council for Scientific and Industrial Research (CSIR), is an investment in research and development aimed at enabling South Africa to take full advantage of all the potential economic benefits that this advanced technology can offer.

The DSI and other stakeholders are working towards a million individuals with data science skills by 2030.



Young data science students continue to benefit from the Department's DSIDE initiative.

"It's a huge task to reach this target, and the DSI and the CSIR will not be able to achieve this on their own. It will take a concerted effort by government, the private sector, higher education institutions and online academies to upskill individuals," said Karel Matthee, Principal Researcher at the CSIR. Matthee said that, over the years, the programme had delivered a number of exciting projects and had the potential to make a significant contribution to the country's future.



"The idea has always been to expose students to a challenging environment," said Matthee. "To let them work in teams and through team effort come up with interesting solutions that can take our country forward."

Data science employs techniques and theories drawn from many fields in the broad areas of mathematics, statistics and computer science, among others, extracting knowledge and insights from data in various forms. The students, who came from universities all over the country, were either in their third or final year of undergraduate studies in the fields of engineering, computer science, business informatics and statistics. The teams are led by mentors who guide them over a 12-week training period.

The programme has seen students use up-to-date approaches such as machine learning techniques to develop new models and insights for their respective datasets. The training culminates in an exhibition of the projects.

Among the popular projects showcased last week was a data-science solution using biometrics to protect children against identity theft and human trafficking. Current biometric systems like face recognition and fingerprinting are designed for adults and cannot be used for children, as their features are not fully developed and their fingers are too small.

The DSIDE programme has resulted in over 33 data science prototypes with potential for commercialization.

Siphehile Gama, Ruan Pretorius, Prince Ngema, Macdaline Mathye, all from the University of the Witwatersrand, and Vukosi Rikhotso from the University of Limpopo worked to refine an "ear detection" project that was started by the CSIR three years ago.

The CSIR's work focused on using three biometric pointers (shape of ear, fingerprints and iris measurements) to solve the challenge of identity theft in children. However, the project had its shortcomings, which the students sought to address through data-science and developing a more user-friendly methodology.

"The model was too slow," said Siphehile. "It was not fast enough to use for large numbers of people, particularly when information needs

to be processed quickly. To strive for more expedient and accurate ear detection, it was necessary to look at a more advanced technological method, known as YOLO – you only look once."

He said the idea was to have cameras mounted in public spaces and, using either image or video detection, to capture data on everyone in such spaces, including children or women

Another initiative that attracted huge interest was a facial recognition initiative developed by students.

The DSI and other stakeholders are working towards a million individuals with data science skills by 2030.



who might have been reported as missing. People would need to pass by the cameras only once for their features to be captured. "The method will not require people to use their fingerprints or touch some machine for them to be recognised," added Siphesihle.

For this technology to be applied successfully, public-private partnerships would be needed to place more cameras in public spaces, and a database of people's ears would have to be compiled.

Another initiative that attracted huge interest was a facial recognition initiative developed by students from the University of Limpopo. Noxolo Maluleke said their task was to develop a real-time facial recognition system that was age-invariant.

She said that facial features change with age, making recognition systems unreliable, and criminals who spent time in prison often got tattoos that made their faces unrecognisable when they were released.

Noxolo also pointed out a bigger challenge for people from Africa, as the majority of facial recognition systems used in the developed world could not be used for black people. The system developed by the students had to consider all these challenges. They set to work on a dataset of human

images, and used an artificial intelligence-based technology able to identify a person by analysing patterns based on the individual's facial textures and shapes.

"To achieve this, a dataset of images containing individuals of different age groups was assembled using a facial ageing augmentation technique. The model gets the outline of each person's facial features (eyes, nose, mouth and chin) so that it can tell who the features correspond to. With the help of this facial recognition technology, law enforcement agencies could increase the chances of tracking down criminals," Noxolo added.

Other projects included data-science solutions for language translation, municipal debt management and pothole detection on the country's roads. The DSI's Deputy Director: Information Communication Technology, Zamokwakhe Dlamini, said the programme has grown from 12 students to more than 275 over the past five years.

"There are also over 33 data science prototypes at the CSIR with potential for commercialisation," she said. "The DSI is in the process of finalising a decadal plan for the implementation of the White Paper on Science, Technology and Innovation, and will be looking at ways in which DSI can change its format in terms of impact and scale," added Dlamini. □

Majority of facial recognition systems used in the developed world could not be used for black people.

– Making sure it's possible –



The provision of high-quality skills and innovation are inseparable partners in the development of a modern economy, said the Minister of Higher Education, Science and Technology, Dr Blade Nzimande, during the annual Black Business Council Summit.

Addressing the summit last week on the topic of skills development ("Skills needed for the future"), the Minister said there could be no modern economy without an effective combination of skills and innovation.

The Minister told the audience, which included thought leaders, government ministers, academics, economists, professionals, organised business and representatives of affiliated members of the Black Business Council, that education, training, science and innovation were important areas for investment.

"One of my priorities is to work closely with the private sector, including the Black Business Council, in a partnership for skills development and innovation. Our task is not merely to return our old economy to growth and development, but to take it on to higher value chains through the provision of

skills and innovation for new industries. As you are aware, education and skills development is one of the seven priorities of this 6th administration," said the Minister.

Government is investing in post-school education and training (PSET) as an important way of transitioning between school and the workplace.

The Minister said that the period between 15 and 24 years was the most critical period in the lives of the country's young people, and it was often access to quality post-school education and training that made the difference between success or failure in life.

This year government is going to be spending R35bn through the National Student Financial Aid Scheme (NSFAS) to support more than 700 000 students in universities and in technical and vocational education and training colleges.

A task team will also be appointed to investigate the feasibility of establishing an affordable higher education loan scheme to cater for those families that do not qualify for NSFAS, but are not wealthy enough to afford university

studies – the “missing middle”. The Minister highlighted that one of the biggest weaknesses in the PSET system was the poor relationship between industry, universities and colleges, which resulted in a failure to produce work-ready graduates or graduates capable of starting their own enterprises.

“Quality post-school education and training is the joint responsibility of government and industry and we must therefore stop the blame game and work together. It is for this reason that I have decided to prioritise the building of relations between my ministry and industry by appointing Mr Nqaba Nqandela as my industrial envoy – to build sustainable relations between my ministry and our two departments [Higher Education and Training, and Science and Innovation] on the one hand, and industry on the other hand. I urge you as the Black Business Council to work with him.”

The Minister told the audience that that black business could not grow without innovation.

He said that the Department of Science and Innovation would this year produce a decadal plan for science, technology and innovation to support the country's economic growth and development objectives. This would build on important work that has been done in the bioeconomy, for instance, contributing to health and agriculture, and in renewable energy.

In his recent state of the nation address, the President announced that a new university of science and innovation is to be established in the industrial heartland of Ekurhuleni. This university will support existing industries, help in the development of new industries, and bring our country to the forefront of cutting-edge technologies.

In the coming weeks, Minister Nzimande will announce the first steps towards the establishment of the new institution. The Minister invited the BBC to partner in the work of the South African affiliate of the World Economic Forum's network of centres for the 4IR. It is intended that the South African centre (one of two affiliate centres in Africa) will have a dynamic partnership with industry and the trade unions, as well as with universities and science councils, and will focus on the governance of technologies in a world of rapid technological changes. The priority areas of focus for this centre must be determined by South Africans.

The Department will also start working with National Treasury this year to start work towards the establishment of an innovation fund to strengthen and support innovation in the country. It is hoped that this will contribute to increasing investment in research, development and innovation over the next decade. ■



– Making sure it's possible –

Indigenous knowledge for economic development



The biannual Indigenous Knowledge Systems Documentation Centres (IKSDCs) forum took place in the Northern Cape this year.

The recently enacted Protection, Promotion, Development and Management of Indigenous Knowledge Act (IKS Act) set the tone for the biannual Indigenous Knowledge Systems Documentation Centres (IKSDCs) forum, a platform designed to share best practices in documenting IK.

The Act, signed into law last August, is aimed at protecting the vast treasure of South Africa's indigenous knowledge (IK) and recognises it as intellectual property that must be protected. The event, held under the theme "Restoring the dignity of IK through quality documentation", took place in Upington, in the Northern Cape, from 2 to 5 March. About 70 delegates from across the country participated in the forum.

The National Recordal System, a flagship project of the Department of Science and Innovation, was established to document IK. This is done through the work of IKSDCs, located throughout country. Prof. Yonah Seleti, Chief Director: Science Missions at the Department of Science and Innovation, believes that the initiative has put South Africa in the lead on the continent in this sphere of work.

"South Africa has become an example to the rest of Africa. We are a country envied by other nations because the South African government is able to allocate resources for the collection and documentation of indigenous knowledge, something that is not happening in any of the other SADC

countries or across the continent," he said. Prof. Seleti told participants that, through their collection of IK, they were reclaiming a past that was not recognised by the apartheid government and that South Africa could be built into a great nation using its own knowledge, values and world view.

Jan Pieterse, an IKSDC recorder from the Northern Cape, said that IK holders in the Northern Cape are very enthusiastic about the documentation process, as they want to ensure that their knowledge will be preserved for future generations. He explained that the process of documenting knowledge was a long one, as many knowledge holders can know about many different uses for one plant. In his experience, the biggest concern among the knowledge holders and practitioners was the issue of recognition and ownership of the knowledge, and what the knowledge will be used for.

A recorder from Gauteng, Onalenna Pega, said there that some indigenous knowledge holders were still reluctant to participate in the documentation project. "There is a great need to hold community engagement workshops to

educate the communities about the project in order for us to build trust. Some knowledge holders are still sceptical and are not revealing all their knowledge to the recorders. They have cited possible exploitation and theft of knowledge,” said Pega. Maphata Ramphela, Director for Heritage Services at the Gauteng Department of Sport, Arts, Culture and Recreation and a project manager at the province's IKSDC, said that the provincial government is serious about IK and implementing the Act.



DSI officials Dr Yonah Seleti, Chief Director Science Missions at the Department of Science and Innovation and Carol Van Wyk, Director Knowledge Management Systems led the discussion at the forum.

Ramphela, a graduate in anthropology, said the IK she learnt from her grandfather helped shape her career choice.

“My grandfather taught us the value of traditional medicine from a young age and I developed a huge interest in IK. My research topic during the completion of my postgraduate degree in anthropology was the use of traditional medicine in healing young children from birth to two years of age. The findings of my research were presented to a number of health organisations.” Ramphela believes that IK can contribute to finding solutions for the current challenges facing society.

“It is very important to document IK so that future generations can find ways of progressing through IK. Indigenous knowledge has the potential to build the economy,” she said.

Prof. Seleti echoed her sentiments. He believes that IK can create jobs, products and services that South Africans will benefit from.

The latest development in the implementation of the IKS Act was the appointment of a 13-member steering committee by Minister of Higher Education, Science and Technology, Dr Blade Nzimande. The committee will focus on the accreditation of institutions for the recognition of prior learning in African traditional medicines. □



IKSDC recorders raised a number of challenges still being experiences in communities.

– Making sure it's possible –

iThemba LABS

a beacon of research excellence and transformation



Deputy Minister of Higher Education, Science and Innovation, Buti Manamela toured the various research facilities at iThemba Labs.



iThemba LABS has about 100 high-level scientific expert students participating in high level research projects.

The Deputy Minister of Higher Education, Science and Innovation, Buti Manamela, has praised the work being carried out at the iThemba Laboratory for Accelerator-Based Sciences (iThemba LABS). iThemba LABS, a business unit of the National Research Foundation (NRF), which is a public entity overseen by the Department of Science and Innovation, brings together scientists working in the physical, medical and biological sciences.

The Deputy Minister visited the facility this week, and lauded the staff for the incredible science they were carrying out.

He visited the 32-year old separated sector cyclotron, an accelerator that produces particle beams for nuclear physics research, particle therapy research and the production of radioisotopes, which, among other things, are used to treat cancer.

Radioisotope production at iThemba LABS is an example of research that supports innovative and relevant solutions. Over the years, the facility has developed a global reputation for the production of high-grade radioisotopes and radiopharmaceuticals.


Hosting the Deputy Minister, Dr Faiçal Azaiez, the iThemba LABS Director, thanked the Department for its ongoing support for the facility.

"Excellence and sustainability are the bedrock of the institution; the quality and innovative character of our research has made us into a reputable global institution," he said.

The facility is counted as one of the best in the world, with similar institutions Brazil, Australia, Argentina and Australia. Research at iThemba LABS is driven by the need to bring about societal benefit, aligning the facility to the country's developmental agenda.

"The lab prides itself in supporting industry and academia as a national facility for basic and applied research, development and training in accelerator-based science. The impact of this specialty is chiefly on nuclear medicine and material research in nanoscience."

Central to the iThemba LABS work is its commitment to transformation in academia and the industry. "iThemba LABS has about 100 high-level scientific expert students, and produces about 150 publications a year," said Dr Azaiez, "And we are just beginning."

The Deputy Minister met several students during his tour of the facility and assured them that the Department of Science and Innovation would continue to offer support to the institution through the National Research Foundation and related stakeholders. 

Nixtamalization adds value for smallholder maize producers

The Department of Science and Innovation (DSI) and Grain South Africa are partnering on an innovative maize project to boost food security in rural communities. Residents from the Elukwatini district in Mpumalanga recently showcased skills acquired during training in nixtamalization, a process of preparing maize in an alkaline solution, which is followed by washing and grinding to produce a dough called masa.

A variety of products can be made from this dough, and local villagers who have mastered the process are adding value to smallholder maize production using masa to make steamed bread, fortified porridge, pancakes, yoghurt and snacks.

The DSI realised the benefits of nixtamalization in 2018 following a visit to South Africa by a group from Mexico who demonstrated the process at a workshop held at the Agricultural Research Council.

The Mexican nixtamalization process is similar to one used by South African rural communities using wood ash to

soften maize, but the Mexican process has proved more effective, said Beaula Mathebula from the DSI's Agricultural Biotechnology Unit.

The former manager of Grain South Africa's Farmer Development Programme, Jane McPherson, tried out the process in her own kitchen, with successful results. The Agricultural Biotechnology unit of the DSI and Grain South Africa pooled their resources to launch the project and have since held 340 courses, training about 4 145 people.

Additional courses presented to support the nixtamalization training include 79 courses on basic nutrition, which benefited 1 246 participants, and 82 courses on dry bean production, which were presented to a total of 1 195 participants.

The success of the nixtamalization project demonstrated the benefits of agroprocessing in providing food and nutritional security. Small-holder farmers play an important role in providing food and nutrition security to local communities



The nixtamalization project has demonstrated the benefits of agroprocessing in providing food and nutritional security.

- Making sure it's possible -

A variety of delicious products can be made from this dough, and local villagers who have mastered the process are adding value to smallholder maize production using masa to make steamed bread, fortified porridge, pancakes, yoghurt and snacks.



in South Africa. They supply food (major staples) to the local markets that supply many of those communities. They are also more labour-intensive than large commercial farms and therefore a major provider of employment in poor rural communities. Uplifting smallholder farmers can help to address many socio-economic challenges in poor rural communities.

The National Development Plan (2030), the New Growth Path and the Industrial Policy Action Plan all acknowledge the need for small-holder producers to participate more in agroprocessing initiatives. Agroprocessing provides additional value to raw products, and enable producers to improve the profitability and sustainability of their farming business. Agroprocessing is therefore able to contribute to the alleviation of socio-economic challenges, increase employment, and improve food and nutrition security.

In South Africa, however, smallholder producers lack access to the agroprocessing industry, owing to a lack of infrastructure, poor knowledge or limited market access.

The nixtamalization project has proved to be a successful form of agroprocessing, providing a number of benefits for unprocessed grain. The process makes grinding maize easier, increases available protein and micronutrient content, improves flavour and aroma, makes starch more digestible, and reduces mycotoxins. The process requires minimal equipment and ingredients and therefore is cheap to carry out. Only a cast iron or stainless-steel pot (instead of an aluminium pot) and slaked lime (calcium hydroxide) are needed.

Since infrastructure is not a major requirement and the market is very open to maize-based products, the key to introducing nixtamalization is to provide knowledge, and the project therefore focused its efforts on training producers to process maize through nixtamalization.

The success of any such intervention depends on buy-in from participants, and an intervention intended to help smallholder farmers access the benefits of agroprocessing had to be relevant to local conditions. The nixtamalization training project took a promising technology from Mexico, repackaged it to fit the local farming landscape and then provided extensive training courses, manuals and recipes in several poor rural districts where maize is a staple food.

From there on, producers innovated to create their products, incorporating local traditions and uplifting their communities.



South Africa and Germany agree to expand the MeerKAT telescope



The international Square Kilometre Array (SKA) Board of Directors has approved a proposal to extend the MeerKAT radio telescope by constructing an extra 20 dishes, jointly funded by South Africa and Germany to the tune of R774,4 million.

The extra dishes or antennas will add to the 64 MeerKAT dishes already constructed at the SKA site in the Karoo, led by the South African Radio Astronomy Observatory (SARAO), which designed, built and operates the 64-dish SKA precursor telescope.

A large portion of the budget for the addition antennas falls within the scope of the SKA construction and will be a contribution to the construction of SKA Phase I.

Germany's funding will be through the Max Planck Society's Institute for Radio Astronomy. The 20 extra dishes will be constructed at designated locations together with all

supporting infrastructure such as foundations, roads, power, fibre, water supply, security as well as upgrades to the Karoo substation.

The SKA, an international effort to build the world's largest radio telescope, will be a collection of telescopes and associated instruments, called an array, spread over long distances and hosted in South Africa and Australia. It will conduct transformational science to improve our understanding of the universe and the laws of fundamental physics, monitoring the sky in unprecedented detail and mapping it hundreds of times faster than any current facility.

With the completion of the MeerKAT in 2018, South Africa proved its competence in astronomy and engineering to host a world-class scientific project of this scale. The MeerKAT is currently the world's largest radio telescope, and will remain so until the SKA has been built.

– Making sure it's possible –



The MeerKAT will be integrated into phase one of the mid-frequency component of SKA Phase I, with an additional 133 dishes added to this phase. The extension project will enhance the science capability of the MeerKAT while putting South African scientists in a stronger position to participate in the SKA science programmes.

The early SKA construction activities are expected to reduce the schedule pressure for the SKA I construction phase, specifically for the infrastructure and the dishes, both of which are considered critical path items.

This will also demonstrate concrete progress to SKA funding stakeholders, enhance confidence in the project, and mitigate the risk of losing the capabilities in the infrastructure and dish design teams over the two-year dormant period leading up to the issuing of construction contracts by the SKA Organisation.


The 20 additional dishes for the MeerKAT expansion are expected to be completed by the end of 2022, with the project due to start in August 2020.

The project is expected to create jobs and business opportunities for local contractors and industry, as it will

involve upgrades of roads, roll-out of fibre and electricity cables, manufacture of MeerKAT components and other associated activities.

Meanwhile, the global SKA project's team of engineers has successfully completed all essential infrastructure designs required for SKA Phase I. For the last five years, two engineering consortia have been hard at work at their sites in Murchison, Western Australia and the Northern Cape, South Africa, designing all the essential infrastructure required for construction of this complex global project to get under way.

This includes access roads, power, water and sanitation, buildings, antenna foundations, and the communication, security and site monitoring equipment required to support the SKA telescope.

Following the successful review of the key infrastructure components of the SKA – considered a major engineering victory – the project has now moved into the bridging phase. The formal transition processes will be completed by September 2020 and the SKA Observatory will become operational in the fourth quarter of 2020. 

***The project is
expected to create
jobs and business
opportunities for
local contractors and
industry.***

Demystifying CRISPR gene editing

As the novel coronavirus SARS-CoV-2 (the name of the virus that causes the COVID-19 disease) spreads rapidly across the world, claiming hundreds of thousands of lives, and infecting many more, the demand for fast tests and treatment options soars. The standard tests in most countries have been described as too slow and cumbersome for the current environment and scientists are working around the clock to find a quicker and more effective test, a vaccine, and specific treatments for virus.

Among the scientific approaches to the pandemic is CRISPR, a gene-editing technology currently revolutionising the scientific world.

CRISPR holds the potential to eliminate diseases, create higher-yielding crops, eradicate dangerous pests and resurrect extinct species, and, in the future, even lead to “designer” babies and eternal youth.

The possibilities of CRISPR technology cannot be ignored, and neither can the ethical concerns related to gene editing. The rapid pace of scientific change necessitates public understanding and knowledge to keep pace with what Dr Mark Behlke, an expert in the field, says “could lead to one of the greatest scientific revolutions in recent times.”

But what is CRISPR technology?

CRISPR stands for “clustered regularly interspaced short palindromic repeats”, and is a family of gene/DNA sequences found in single-cell organisms like bacteria that don't have a distinct nucleus. With CRISPR technology, these DNA sequences are used as a gene-editing tool, or a pair of “molecular scissors” to cut and edit the DNA in the cells of plants and animals, including humans. The CRISPR system can

recognise any short DNA sequence in plant and animal cells, cut it out, and insert a new one.

Besides cutting, you can “regulate activation or suppression of certain genes by using CRISPR not as a cutting tool, but instead as a binding tool to attract activators or repressors to induce traits.”

What makes CRISPR more appealing than other genetic engineering tools like those used in genetically modified organisms (GMOs), is that CRISPR is more precise, cheap and easy to use, as well as versatile and remarkably powerful.

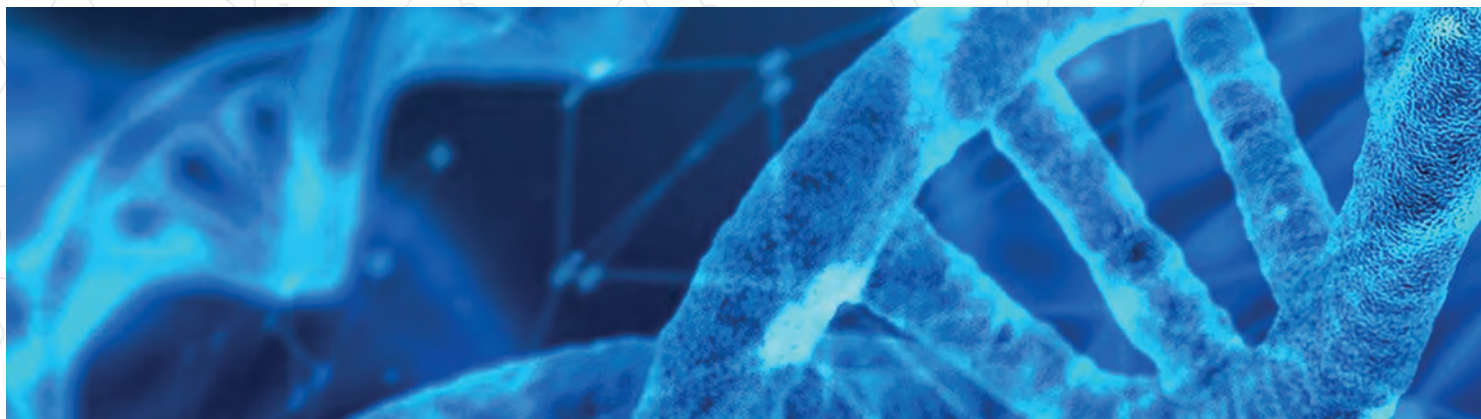
What are the benefits of CRISPR technology?

The technology has many benefits, some of which are described below. *CRISPR could correct the genetic errors that cause cancer and other diseases*

Genetic errors may be inherited from parents, or could result from mutations that occur during gene replication associated with the normal growth of cells.

Some life-threatening hereditary diseases are caused by an error on a single gene. Single-gene disorders include cystic fibrosis (which causes the body to produce thick, sticky mucus that can clog the lungs and obstruct the pancreas), haemochromatosis (a disorder where too much iron builds up in the body, which can lead to life-threatening conditions like liver disease, heart problems and diabetes), and sickle cell anaemia (where the red blood cells, the oxygen carriers in the body, are irregularly shaped, become rigid and sticky, and get stuck in small blood vessels, slowing or blocking blood flow and oxygen to parts of the body).

- Making sure it's possible -



With CRISPR technology, disease-causing genes can be cut and a correct gene inserted to cure the disease. Gene alterations (mutations) are characteristic of cancer. The cancer therapies currently available (like chemotherapy and radiotherapy) have harmful side effects, reducing the quality of life of the patient, and are also very expensive. Advances have been made in sequencing technology to explore ways in which the cancer genome can be corrected.

CRISPR could eliminate the microorganisms that cause disease

In 2018, it was estimated that 7.7 million people in South Africa are HIV positive, and although antiretroviral therapy treatments have turned HIV/Aids into a livable health condition, scientists still haven't found a cure. CRISPR could change this. In 2017, a team of Chinese researchers successfully increased resistance to HIV in mice by replicating a mutation of a gene that effectively prevents the virus from entering cells.

Another gene-editing trial will attempt to use CRISPR to disrupt the genes of the human papillomavirus (HPV) (a virus that causes cervical cancer tumor growth), effectively destroying it.

CRISPR could bring extinct species back to life

Dr Ben Novak, who works for conservation organisation Revive & Restore, is using CRISPR to try and bring the passenger pigeon back to life in North America, where it was once abundant. Rock pigeons have become city pests, but the passenger pigeon is different and, "It's not about the bird. It's about what the bird does for the entire ecosystem," says Novak.

A million species are likely to become extinct in the next few decades, and biodiversity is under threat. Bringing back an extinct animal could help to balance an ecosystem, and a biodiverse ecosystem can help to protect water resources, and contribute to climate stability and food security.

CRISPR could create new, higher-quality and higher-yield crops

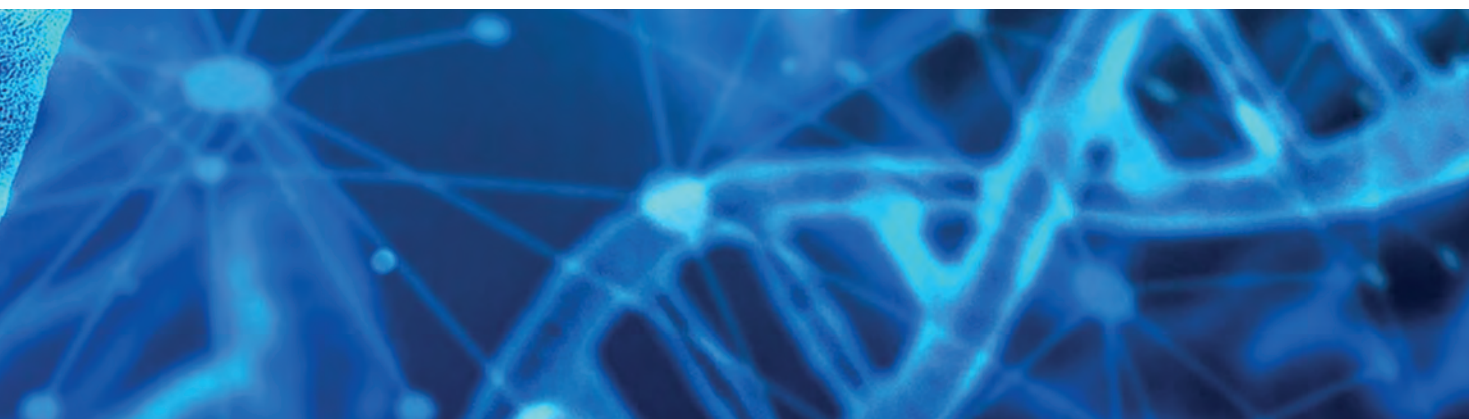
Prof. Yiping Qi, a plant scientist at the University of Maryland, is concerned about providing food for an ever-increasing global population, and is doing extensive research on CRISPR technology in crops. "We will have 10 billion people by 2050," he says. "How can we sustain crop improvement to feed more people sustainably with climate change and less land? I really think that technology should play a big role in that."

While there is resistance to GMO crops, there is less stigma around CRISPR technology. The two methods are very different, with GMOs made by inserting DNA sequences from other organisms into a plant's genome to change plant traits. With CRISPR gene-editing tools, no foreign DNA is introduced. Changes are made to the structure or locations of the genes without introducing foreign DNA.

There is thus greater acceptance of CRISPR crops than of GMOs. In 2016, the US Animal and Plant Health Inspection Service confirmed that a CRISPR-edited mushroom did not need to pass through the Department of Agriculture's regulatory processes because it did not contain foreign DNA from viruses or bacteria. Australia, Sweden and Argentina, among others, also categorise and regulate CRISPR-edited crops differently to GMOs because no new genetic material is introduced.

CRISPR could eradicate disease-transmitting pests

CRISPR could eradicate dangerous pests, like the malaria-carrying Anopheles mosquito. Malaria is a global concern, but of particular concern in Africa, which carries a disproportionately high share of the global malaria burden. The World Health Organisation's latest fact sheets show that in 2017, Africa "was home to 93% of malaria cases and 94% of malaria deaths. Total funding for malaria control and elimination reached an estimated US\$ 2.7 billion in 2018". Scientists at the University of California developed a kind of mosquito that is uniquely susceptible to changes made with



CRISPR, and are aiming to produce wingless mosquitoes that will not be able to spread malaria. Other researchers focus on changing how mosquitos reproduce. In 2016, a team at the Imperial College London used CRISPR to develop female-sterility traits in the Anopheles mosquito that may be inherited by their offspring.

What are the concerns about CRISPR technology?

CRISPR technology provides scientists with the power to alter DNA – the source code of life itself – with ease and relative accuracy. This power brings with it many ethical questions and concerns. Of particular concern is that the editing process can result in off-target DNA being changed, causing unwanted effects. What if CRISPR makes changes in the wrong place and unintentionally alters or removes healthy genes?

It is important to distinguish between CRISPR techniques used for somatic gene editing (which alters genes in an individual and is not passed on to offspring) and germline editing (the editing of sperm, egg cells or embryo cells, which results in traits passed on to future generations of the organism).

Given the many benefits of CRISPR technology, many people will not be too concerned about somatic cell editing, mostly because if the technology goes wrong the risks are confined to the organism being experimented on. For people, this means that a patient suffering from a disease that can be corrected can give informed, voluntary and rational consent to the gene-editing experimentation. This means that the individual accepts the risks associated with the CRISPR study without influencing his/her future offspring.

In contrast, germline editing, in which species could be permanently changed or eliminated is ethically less palatable. For instance, although malaria is a great killer transmitted by Anopheles mosquitoes, interfering with mosquito populations could have unintended consequences.

“Eliminating a species, even one that doesn’t appear to have much ecological value, could upset the careful balance of ecosystems. That could have disastrous consequences, such as disrupting the food web or increasing the risk that diseases like malaria could be spread by different species entirely,” explains journalist Victor Tangermann.

Furthermore, germline manipulation of human embryos, even with good intentions, is considered a no-no even by CRISPR scientists, especially as CRISPR technology is still in its infancy.

For instance, crossing this ethics line was more than career limiting for Prof. He Jiankui, who not only lost his job but was also sentenced, on 30 December 2019, to three years imprisonment and ¥3 million fine. This followed a huge public outcry when He Jiankui announced in 2018 that his team had successfully created the world’s first genome-edited (“designer”) twins, who were born from genetically modified embryos that were made resistant to HIV.

Conclusion

CRISPR technology is revolutionising science and, as it becomes more refined, is likely to have many more benefits, from curing diseases to improving crops.

However, if the pace of scientific progress moves faster than the pace of public awareness and understanding, there is a risk that the technology will face public rejection. It is therefore important to improve public understanding of what CRISPR is and what it offers us, as well as clarify the difference between germline and somatic gene editing to prevent misinterpretations.

“Bioethicists and researchers generally believe that human genome editing for reproductive purposes should not be attempted at this time, but that studies that would make gene therapy [to treat diseases] safe and effective should continue,” advises Mark Behlke. □

– Making sure it's possible –

COVID-19 pandemic highlights importance of international science diplomacy

The COVID-19 pandemic currently wreaking havoc across the globe has highlighted the need for countries to work together, with knowledge sharing and adherence to best practice proving critical in the absence of a vaccine against the novel coronavirus.

The Department of Science and Innovation (DSI) has long recognised the importance of science diplomacy, and through its International Cooperation and Resources programme has invested significantly in building relationships across the world in science, technology and innovation (STI). As part of this drive, the Department recently hosted an inaugural training workshop in STI diplomacy in partnership with the India-based Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), the Academy of Science of South Africa (ASSAf), and the Department of International Relations and Cooperation (DIRCO). The week-long workshop took place in Pretoria in November and December.

Mmampei Chaba, Chief Director: Multilateral Cooperation and Africa at the DSI, said that STI diplomacy training would be a fixed feature of the Department's international programme going forward. Ms Chaba said that STI diplomacy could be used to support various national and regional priorities. For example, it could facilitate increased exports of scientific knowledge and technologies, thereby advancing investment in the Southern African region and the continent as a whole. Referring to the South African experience, Ms Chaba said the country had one of the highest levels of inequality in the world, and that for decades science had been used to advance the needs of the privileged few. This had now changed, and there was consensus at the highest level that STI was key to addressing the country's triple challenge of poverty, inequality and unemployment.


"This role of science in inclusive socio-economic development is highlighted in the country's National Development Plan, and clearly articulated in the 2019 White Paper on Science, Technology and Innovation," she said. Ms Chaba thanked the NAM S&T Centre for its contribution to the successful inauguration of STI diplomacy training in partnership with the Department. The DSI's partnership with the centre



stretches back four to five years, and has seen over 100 people trained in minerals beneficiation. The NAM S&T Centre is an inter-governmental organisation that aims to promote the collective self-reliance of developing countries through cooperation in science and technology. The centre currently has 47 member countries from Latin America, Africa, Asia and Europe, and has organised 116 international workshops and training courses to date.

The centre's Director-General, Dr Amitava Bandopadhyay, said that STI diplomacy was essential to resolving challenges around energy supply, food security, health and hygiene, and the availability of safe drinking water. Dr Bandopadhyay had words of praise for South Africa's scientists and experts, saying they always participated actively and in large numbers in NAM S&T Centre events. Tinyiko Kumalo, Acting Deputy

Director-General: Branch Diplomatic Training, Research and Development at DIRCO, was also pleased by the interest shown by local scientists in STI diplomacy. She said that meaningful collaboration between scientists and diplomats was crucial for succeeding in a fast-changing environment. "As diplomats we need to be on the look-out for scientific projects that will help with achieving domestic and continental priorities," Ms Kumalo added.

ASSAf's International Liaison Manager, Stanley Maphosa, said that through science diplomacy, ASSAf sought to enable the use of scientific knowledge to tackle societal problems that cut across multiple countries. ASSAf is an entity of the DSI that conducts a range of work in science diplomacy, public engagement on science, and the provision of evidence-based science advice. 



South Africa hosted the first instalment of international training on STI diplomacy together with its partners, NAM, DIRCO and ASSAf.

– Making sure it's possible –

3D printing technologies and innovation

to take South Africa forward

South Africa's additive manufacturing (AM) capabilities have matured at a rapid rate, thanks to purpose-led interventions by stakeholders including the government, industry and academia.



Letsoalo Letsoalo, Project Engineer at CUT's Centre for Rapid Prototyping and Manufacturing (CRPM) introduces stakeholders to the CUT's technology.

Additive manufacturing, also known as 3D printing, involves the use of computer-aided design models to produce three-dimensional objects. This is usually done by adding material layer by layer, hence the name additive manufacturing.

The Department of Science and Innovation (DSI) supports the development of AM in the country in various ways, including through funding and support for the Rapid Product Development Association of South Africa (RAPDASA).

In November, the DSI partnered with the Central University of Technology (CUT) to host RAPDASA's 20th annual conference and exhibition in Bloemfontein. The event has grown significantly over the years, reflecting the growth of the sector in its shift from being largely academic to becoming an important showcase for companies in the industry.

Among the companies that exhibited at the event was Pretoria-based Aditiv Solutions, a tech start-up that produces high-quality, affordable AM equipment, including a low-cost 3D printing machine known as the HYRAX. Marius Vermeulen, the company's Managing Director, said the HYRAX uses powder bed fusion technology to manufacture parts from a range of non-reactive metals.

AM allows for the manufacturing of complex parts directly from metal powder, and has many advantages over conventional manufacturing processes. However, due to the cost of AM machines, metal 3D printing is expensive and often not suitable as a production solution.

"Our team specialises in high-end AM machine building by employing the latest software technologies in machine design, simulation, code development and product life-cycle management," Mr Vermeulen said. This enabled the company to offer consumers a 3D printer at a fraction of the cost of similar machines on the market.

The conference programme gave participants from industry, academia and government the opportunity to gain insights from local and international experts such as Dr Terry Wohlers, President of Colorado, USA-based Wohlers Associates.

Dr Wohlers told delegates that the next challenge for AM was "to drive cost out of the machines, drive the speed up, and make more types of material at lower cost". He said the focus should be on how to bridge the gap from where we are today to actual manufacturing.

"It is one thing to use AM to make parts for designs and make validations for designs, but it's a whole other challenge and opportunity to scale into production."

Letsoalo Letsoalo, Project Engineer at CUT's Centre for Rapid Prototyping and Manufacturing (CRPM), said the university was always excited to demonstrate its progress in AM technologies and research at RAPDASA's conference.



Marius Vermeulen showcased the HYRAX 3D printing machine at the 2019 RAPDASA exhibition.

CUT is leading the way in the application of AM for the design and production of customised medical implants, thus reducing the country's reliance on costly imports. In 2016, the CRPM became the first centre in Africa to receive International Organization for Standardization (ISO) certification for 3D printing of medical devices.

"Over a decade, the university successfully focused on AM patient-specific implants and devices, which led to the first South African 3D-printed hemi-mandible implant," Mr Letsoalo said. "This was followed by a further 60 successful AM cases, including surgical implants of the maxilla or upper jaw bone."

CUT hosts the DSI Innovation and Commercialisation of Additive Manufacturing Chair, which was launched in 2018 in collaboration with the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA). The university also hosts the SARCHI Research Chair in Medical Product Development through Additive

Manufacturing, which is part of the DSI's South African Research Chairs Initiative (SARCHI). The South African Additive Manufacturing Strategy, launched by the DSI in 2016, identifies future market opportunities and focus areas that can guide investment in AM research, development and innovation. South Africa is already demonstrating world-class capabilities in AM following significant investment in the sector. This has positioned the country to participate in sub-sectors with high growth potential in AM, such as aerospace applications and medical and dental devices and implants.

Since 2014, the country's public sector has collectively invested approximately R358 million in AM research and development (R&D) and systems. In addition, the DSI has committed R30,7 million to a collaborative programme focusing on the production of titanium medical implants and aerospace components using AM. The programme also seeks to increase the adoption of AM as a viable manufacturing technology. □

– Making sure it's possible –

Learners exposed to space science and technology

Over 2 000 grade 10 to 12 learners from the Greater Taung Local Municipality (GTLM) took a break from the normal school day to consider their future careers.

The learners attended a career day at the Taung Depot Hall on 21 February, an event hosted by the Department of Science and Innovation (DSI), in partnership with the GTLM, the Dr Ruth Segomotsi Mompati Education District, and the South African National Space Agency (SANSA).

Held under the theme, "The role of space science and technology in the Fourth Industrial Revolution", the event provided a platform for learners to explore their interests and passions and in the process understand themselves and the world better. Encouraging the learners to take responsibility for their choices, Mmboneni Muofhe, the Deputy Director-General: Technology Innovation at DSI, said that the Department and its partners had come to Taung because they realised the value of learners being informed to make decisions about their future.

"We are here to introduce you to exciting careers available in the field of space science and technology. We urge you to use the opportunity we are bringing to you and make sound choices. When you visit the exhibition stalls and engage exhibitors, you are consciously building the future you deserve. Make sure that you ask relevant questions to get proper guidance, as there are also pointers about possible funding," Muofhe said.

He cautioned learners not to waste time, but rather to make their own informed decisions, as this would affect their futures. "The choices you make now concerning your future cannot be made by teachers or your parents. Understand that the choices people make when they are young like you are now will determine the kind of life you will have when you are older," he advised. Mpho Lencwe, a Taung resident currently completing a PhD at Tshwane University of Technology, encouraged learners to follow their dreams and not to allow their background to determine their future. He urged learners to live purposefully, setting clear goals and using the opportunities afforded to them.

"Back in 2007 when I was completing grade 12, my friends and I were not good in languages but excelled in mathematics,

physics and biology. We then paired with learners who were good in languages and shared knowledge among ourselves. It was a win-win situation for all of us," Mpho said.

SANSA's Dan Matsapola told learners that space science and technology were no longer the exclusive preserve of rich countries. "Even the poorest countries can participate and that is why we thought it appropriate to bring the space science and technology career day here to rural Taung."

He talked about upstream and downstream career possibilities in space science. Upstream careers include systems engineering, which focuses on how to design and manage complex satellite systems over their life cycles. Downstream careers include highly specialised fields like remote sensing engineering, which involves analysing data from satellites using statistical analysis and image analysis software for geographic information systems.

Kerapetse Makhoana, Greater Taung Education Sub-District Manager, thanked the DSI for its efforts, saying the day had given learners a better understanding of the world of work. Talking about the importance of career guidance, she said awareness would help improve the learners' attitudes to science and encourage them to venture into careers they were interested in. Grade 12 learner Kemogitse Tsekang, from Gabobidiwe High School, said she was excited to learn about the engineering of rocket propulsion from the SciBono Discovery Centre's exhibit. She was convinced that everything involves science and everybody, including her mother and younger sister, should learn about it.

"It is now too late for me to change my career path as I want to be a lawyer, but the sciences are inspiring," she said.

Kea Mamathebe, from Letlhogile Secondary School, was intrigued by the information she received on nanotechnology and planned to do further research.

"I now know that nanotechnology is expected to contribute to economic growth," she said.

The career day included science and motivational talks, quizzes and workshops. □

MINISTER NZIMANDE WELCOMES THE NATIONAL ASSEMBLY APPROVAL OF THE SCIENCE AND TECHNOLOGY LAWS AMENDMENT BILL

The Minister of Higher Education, Science and Technology, Dr Blade Nzimande welcomes the National Assembly (NA) passing of the Science and Technology Laws Amendment Bill.

The purpose of the Bill is to amend the Scientific Research Council Act, 1988, the Academy of Science of South Africa Act, 2001, the Human Sciences Research Council Act, 2008, the Technology Innovation Agency Act, 2008, and the South African National Space Agency Act, 2008, in order to harmonise the processes for the termination of the membership of Boards or Councils of the entities established by these Acts.

In the current dispensation, there is inconsistent and uncoordinated management of public entities reporting to Minister Nzimande, characterised by different requirements that regulate their operations.

"The main reason for this Bill is not to simply ensure greater administrative efficiency, cost containment, strategic alignment, but it also intends to drive the post-school knowledge and skills development imperatives more decisively," said Minister Nzimande.

Minister Nzimande said that whilst challenges still persist in some of the State-Owned Enterprises (SOEs), there are those who are doing well in response to the socio-economic challenges of our country.

"Therefore this Bill will ensure that we continue to effectively and efficiently harness the achievements of these SOEs that are doing well," said Minister Nzimande.

Minister Nzimande said through the South African National Space Agency (SANSA), the South African MeerKAT project has been completed on time and within the budget of R3.2 billion.


"The benefits of hosting these telescopes include a 75% local content component, direct investment of more than

R300 million in the Northern Cape by South African Radio Astronomy Observatory (SARAO) alone," the Minister pointed out.

Minister Nzimande said through the Technology Innovation Agency (TIA), government continue to harness the latest advances in smart agriculture.

"In this regard, we are substantially expanding the agriculture and agroprocessing sector by supporting key value chains and products, developing new markets and reducing our reliance on agricultural imports," said Minister Nzimande.

The Minister said that Bill also aims to, amongst others, clarify the requirements for the disqualification of persons from membership of Boards or Councils; to provide for the appointment of external persons to committees of Boards or Councils; and to provide for the determination of the remuneration and allowances of members of the Boards or Councils and committees of the Boards or Councils.

"This Bill also seeks to harmonise the processes for the determination of the remuneration and allowances of the members and committees of the Boards/Councils, emphasised Minister Nzimande. 

– Making sure it's possible –



Shai shattering stereotypes

More and more women are pursuing artisanal careers, proving that gender is irrelevant when it comes to getting the job done. The electrical trade has for decades been dominated by men, but that is beginning to change as women prove that they have what it takes excel in this field.

One such pioneering young woman is Mmatsatsi Shai, a qualified electrician and the first female Maintenance Officer to be appointed at the Department of Science and Innovation (DSI).

Shai started her career with the DSI last November, and is responsible for ensuring that the Department's offices are adequately lighted and the electrical circuits in perfect working condition.

Mmatsatsi Shai, the DSI's first female Maintenance Officer. Shai says gender shouldn't be an obstacle in achieving one's dreams.

Shai, who grew up in GaMametja, Tzaneen in Limpopo, credits her decision to enter the technical field to one of her high school teachers, who encouraged her to pursue tertiary studies. "I did well in mathematics and physical science. I suppose that is what my teacher saw in me, and am thankful he guided me in the right direction," she said, adding that her teacher had encouraged her to study electrical engineering.

While South Africa has made great strides in gender equity, employment of artisans and technicians continues to be dominated by men, according to a 2015 report compiled by the Department of Trade and Industry, "Facts and Figures on Skills in Manufacturing".

The report shows that there was a significant reversal of gains in the employment of women artisans between 2002 and 2013, with a decline of over 10 percentage points from 35,4% to 24,5%. Prior to joining the DSI, Shai worked for Maredi Telecoms and Bidvest Facilities Management, and was responsible for building maintenance at BMW's Rosslyn plant.

"I am used to comments and surprised stares from colleagues when they see me on a ladder," Shai said. "I don't see anything wrong with a woman climbing a ladder to reach high places – it happens in the house for hanging curtains, and on the farm during harvesting, so why not in the office space?"

Shai said she is treated fairly by colleagues at the DSI, and that no one has ever made her feel inferior because of her gender. A mother of two girls, she added there are unique challenges that female electricians experience that their male counterparts don't go through. It is obviously impossible to climb ladders during pregnancy, she said, as the centre of gravity shifts, making it harder to stay balanced.

"In this instance one makes decisions that are in the best interest of one's health, but it's not insurmountable," she added.

Shai believes the environment has become very supportive of women, and that anyone can excel irrespective of their gender. She actively encourages girls in her community to pursue careers as artisans.

Shai holds a national diploma in electrical engineering from Ekurhuleni East Technical and Vocational Education and Training College. She intends to further her studies so she can realise her dream of becoming an engineer one day. ▣

Circular economy study tour

looks to apply best practice locally

South African government officials and representatives of stakeholder organisations returned from a recent study tour of circular economy institutions and initiatives in Europe determined to apply the lessons learned in guiding the country on its transition to a circular economy.

The circular economy has been identified as an important new source of inclusive economic growth, and the 2019 White Paper on Science, Technology and Innovation (STI) is one of the first South African policy documents to consider the circular economy in terms of its long-term economic growth potential.

The White Paper defines the circular economy as looking beyond the “take, make and dispose” extractive model that characterises the traditional linear economy, focusing instead on restoring and regenerating. “Underpinned by a transition to renewable energy sources and system-wide innovation, [the circular economy] aims to redefine products and services to reduce waste and negative impacts.”

Identifying the European Union (EU) as leaders in circular economy policy, planning and implementation, the Department of Science and Innovation (DSI) embarked on the process of developing an STI Framework on Circular Economy through the South Africa-EU Dialogue Facility.

It was in order to learn first-hand from circular economy policies and practices in European countries – particularly where these involved science, technology and innovation – that the DSI organised the Circular Economy Study Tour.

The tour was designed to enable delegates to engage directly with institutions and experts that are working in the domain of STI and the circular economy.

With the assistance of the EU Delegation, the DSI identified institutions and experts in Spain, Belgium and the Netherlands, scheduled meetings, and put together a delegation comprising senior officials from key circular economy departments, namely the Department of Environment, Forestry and Fisheries, the Department of Trade, Industry and Competition, and the Presidency. The DSI's entity, the Council for Scientific and Industrial Research (CSIR), was also represented along with the National Business Initiative

and GreenCape.

The study tour began in Spain on 25 November, proceeding to Belgium on 28 November and to the Netherlands on 29 November.

In Belgium, the delegation met with senior officials of the Development Cooperation, Environment, Research and Innovation, and Energy departments, and the EU's Joint Research Centre, to discuss the current policies and research, development and innovation (RDI) initiatives of the European Commission.

In Spain the delegation was hosted by the government environment agency, Ithobe, and its business counterpart, Aclima. And in the Netherlands the delegation was hosted at Blue City in Rotterdam and by the Economic Advisory Board in Amsterdam.

Trudi Makhaya, Economic Advisor to the President and one of the tour delegates, noted that the circular economy “is relevant to the South African context as an economic growth theme as it encompasses measures that could stimulate and support new forms of economic activity. It suggests a path to growing the economy while meeting the country's commitments to reducing greenhouse gas emissions and protecting the environment.”

Another delegate, Dr Henry Roman, Director: Environmental Services and Technologies at the DSI, said what stood out from the trip was “that public procurement is a vital means of transitioning the economy from being linear to being circular”.

And for Prof. Linda Godfrey, Manager of the DSI's Waste RDI Roadmap, “a key issue that emerged from the study tour – including all countries and all organisations that we met with – is the importance of collaboration in supporting a country's transition to a circular economy.” □

Harnessing STI for a just transition to a circular economy

A recent engagement between local and global policy makers and stakeholders on the circular economy, hosted by the Department of Science and Innovation (DSI) in Pretoria, was marked by robust discussion on a just transition to a circular economy.

The Circular Economy Symposium, one of the first dedicated forums hosted by the DSI to engage policy makers and stakeholders on the role of science, technology and innovation (STI) in the transition to a circular economy, was held on 19 and 20 November with 120 delegates in attendance.

The symposium was held under the auspices of the South Africa-European Union Dialogue Facility. Through the SA-EU Dialogue Facility, the DSI has begun developing an STI Framework on Circular Economy that will be central to advancing the circular economy in South Africa.

The concept of a circular economy is embedded in the White Paper on STI that was approved by Cabinet in March 2019. In its report on the South Africa Foresight Exercise for STI, released in December, the National Advisory Council on Innovation (NACI) describes the circular economy as focusing on “the generation of products that are restorative and regenerative by design, and which circulate through the economy repeatedly, thereby minimising waste. This includes the conversion of biological and non-biological waste into new resources and materials, as well as the restoration and protection of biodiversity.”

The purpose of the Circular Economy Symposium was to expose South African policy makers to lessons in circular economy policy making and measurement from key European experts and institutions, highlighting the role of STI in achieving a successful transition to a circular economy.


Speakers included senior officials from the DSI, the Department of Environment, Forestry and Fisheries, and National Treasury, experts from the Organisation for Economic Co-operation and Development (OECD) and the EU's Joint Research Centre, local stakeholders including the private sector, NGOs and civil society, as well as youth leaders in the circular economy.

The sessions covered a range of topics, including circular economy opportunities in South Africa, and the skills and instruments required to make the transition from a linear to a circular economy. The discussions were balanced by robust debate on how to ensure that this transition takes place in a just and inclusive way.

National Treasury Deputy Director-General, Ismail Momoniat, remarked that the circular economy “is too important to leave to one government department, and needs input from a variety of perspectives”. While there are many opportunities to get new players involved and to empower people in the recycling sector, extended user responsibility is an essential element, and government must ensure that there are credible ways of doing things in order to achieve critical mass. The national, provincial and municipal spheres of government all have a role to play.

The European Commission's Circular Economy Action Plan, which has been in place since 2015, was updated in March 2020. The circular economy also features prominently in the commission's new European Green Deal. Europe has invested over €10 billion in the circular economy since 2016, and stands to generate a net economic benefit of around €8 trillion from the circular economy by 2030. One of the main objectives of these policies and investments is to advance the long-term competitiveness of European producers.

Through the SA-EU Dialogue Facility, the DSI has been able to develop an STI Framework on Circular Economy that includes critical reflections on the role of design thinking, extended producer responsibility, material flow analysis, life cycle sustainability assessments, and green procurements. Lessons from circular economy experts have been considered in light of the country's development priorities and the national system of innovation (NSI).

Following the rich engagements under the Dialogue Facility platform, the DSI will turn its attention to finalising the STI Framework with key stakeholders in the circular economy landscape, and providing inputs to the Decadal Plan on STI which is currently being developed, and which will guide the implementation of the White Paper over the next 10 years. 

Protecting people who expose corruption



People often wonder about how the Protected Disclosures Act actually protects whistle-blowers. Obviously, no law will be able to ensure absolute protection or guarantee that whistle-blowers' lives are not adversely affected in some way once they have made a disclosure, but it is vital that employees, both public and private sector, raise the alarm when they are aware of illegal or unethical activities in the workplace. Disclosures are encouraged if you are aware that a criminal offence has been or is being committed, or is likely to be committed. Or if you know or strongly suspect that there has been a miscarriage of justice, or a failure to comply with a legal obligation.

In a world where humans are ravaging the natural environment, whistle-blowers should make a disclosure immediately they suspect that the environment is being damaged. Likewise, if there is danger to human health or safety it would be wrong to remain silent. And with our country's history and our dreams of reconciliation, unfair discrimination should not remain concealed. For a disclosure to count as a protected disclosure, it must meet the requirements of the Act. If the conditions are not met, the Act will not protect whistle-blowers against reprisals.

The overarching requirement is that the employee must make the disclosure about their employer or another employee in good faith. The employee may not make a report for personal gain, for instance, or hoping to destroy a rival's reputation. The whistle-blower must reasonably believe that the information disclosed and any allegation contained in it is substantially true.

The disclosure can be made to an employer, or a body approved by the employer for this purpose, e.g. the Public Service Commission, or the Anti-Corruption Hotline.

Disclosures can also be made to a legal practitioner in the course of obtaining legal advice, or to members of Cabinet, the Executive Council of a province, the Public Protector, the Auditor-General or other bodies relevant to the impropriety being reported. There are various requirements in the Public Disclosures Act for disclosures made to such people or organisations.

Whistle-blowers must follow the correct procedure laid down by their employer when raising the alarm. However, where an employee is unable to comply with the process followed, e.g. if the person or body to which the disclosure must be made is the subject of the complaint, or the employee has previously made the disclosure to the employer but the employer failed to act after a reasonable period, the Act also allows employees to make a general protected disclosure.

Employees who believe that they are suffering occupational detriment after making a protected disclosure may refer a dispute to the Commission of Conciliation, Mediation and Arbitration. Occupational detriment includes dismissal, demotion, harassment or intimidation, being subjected to disciplinary action, being refused a transfer or promotion, or being given a bad reference when applying for another job.

Within the Department, any occupational detriment should be reported to the Director-General, the Chair of the Ethics Committee, the Chief Risk Officer or the Ethics Officers in the Chief Directorate: Human Resources. Employees are encouraged to familiarise themselves with the Department's Whistle-Blowing Policy, especially in respect of making a protected disclosure, or may also approach Human Resources or Enterprise Risk Management for further information. □



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