TTO NEWS

TTO celebrates World IP Day

International collaboration

Awards for UP-created technologies

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Department of Research and Innovation

Departement Navorsing en Innovasie
Kgoro ya Dinyakišišo le Tšweletšopele

Newsletter of the Technology Transfer Office of the University of Pretoria

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Letter from the editor

The central theme of the University of Pretoria's research strategy is to position locally relevant research on the international stage and to increase its visibility and impact.

In this issue of *TTO News,* we are proud to reflect on some of our achievements in this regard. At the Innovation Bridge event that was held in Johannesburg in September 2017, four UP-created inventions were exhibited to the public and potential commercialisation partners. These inventions emanated from the Faculty of Engineering, Built Environment and Information Technology. One of these was for new 5G technology and entailed the development of novel on-chip bypass filters and digital signal processing blocks. This invention also won the 2017 start-up Tel Aviv-South Africa competition earlier in the year, and received one of four awards in the ICT category of the Gauteng Accelerator Programme (GAP) Awards in November 2017.

The Technology Transfer Office (TTO) also succeeded in building valuable international networks with other technology transfer professionals. Refilwe Ngoato, Manager of the TTO, attended two important networking events in China, and a delegation from Tanzania visited the TTO to learn about technology transfer and intellectual property (IP) management from the UP team.

On 25 April 2017, the University joined IP professionals from all over the world to celebrate World IP Day.

The University regularly presents events such as these. You are welcome to attend them to become more informed about IP, to see what is being invented at UP, and to explore how the TTO operates.

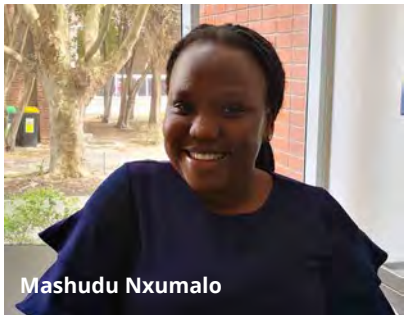
Adv Lawrence Baloyi
Head: Contract Research and Innovation

New staff members

Thabang Qumza

Thabang joined the TTO on 1 October 2017 as the Commercialisation Coordinator Manager. He holds an MBA and a BTech (Chemistry) degree from the Nelson Mandela Metropolitan University (NMMU), and has completed courses in project management, as well as facilitation. He has also completed a range of courses presented by the World Intellectual Property Organisation (WIPO). These include the DL001 Primer on Intellectual Property (IP), Introduction to the Patent Cooperation Treaty, the DL101 General Course on IP, and the DL450 IP Management. In addition, Thabang has been the recipient of a WIPO scholarship to attend the Advanced Course on IP, Technology Transfer and Licensing at the University of Strasbourg in France.

Thabang has 10 years of cross-industry experience, including experience in oil and petrochemicals, strategy consulting, energy, automotive, and paints and coatings.



Mashudu Nxumalo

Mashudu is a Senior Administrative Officer, and has been with the TTO since 1 August 2017. She is a graduate of the University of Limpopo and recently completed her master's degree in Microbiology at UP.

Prior to her appointment at the TTO, she worked at the University as a tutor for first-year molecular biology classes. She was also the Deputy Chairperson of Pledge a Pad, a student society focusing on issues of the menstrual cycle and other sexual and reproductive health aspects that affect women.

Tshepo Kubhai

Tshepo joined the TTO on 1 May 2017 as a Technology Transfer Officer. He holds a BSc in Microbiology and Physiology from the University of Limpopo. He is part of the Department of Science and Technology and National Research Foundation (DST-NRF) internship programme. The NRF manages the internship programme, in which unemployed graduates and postgraduates from science, engineering and technology (SET) fields, as well as the social sciences and humanities, are offered an opportunity to acquire practical work experience through mentoring and exposure to a research environment.

Participation in this programme is also offered to unemployed graduates and postgraduates who are interested in research management, research support and administration at public higher education institutions and research agencies through a partnership with the Southern African Research and Innovation Management Association (SARIMA).

UP's Technology Transfer Office celebrates World IP Day

On 26 April every year, intellectual property professionals from all over the world celebrate World IP Day. At UP, the Department of Research and Innovation's TTO, in collaboration with the Department of Library Services, hosted an IP lunch talk to commemorate this event on 25 April 2017.

Academic staff members, postgraduate students and other IP professionals filled up the Merensky 2 Library Auditorium where the event took place. In 2017, the focus of World IP Day was on how innovation improves lives in terms of health, safety and comfort.

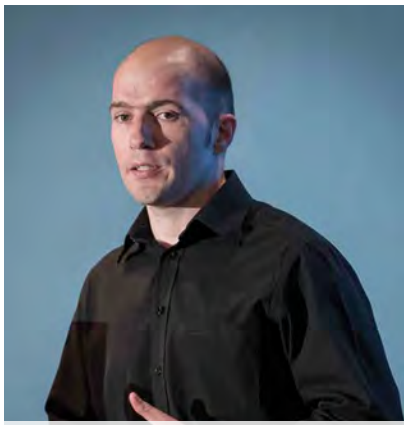
Dr Nthabiseng Taole, Director of the Department of Research and Innovation, welcomed all the guests and speakers after a brief introduction by Refilwe Ngoato, Manager of the TTO, who facilitated the event.

Dr Herman Myburgh, a senior lecturer in the Department of Electrical, Electronic and Computer Engineering, and co-inventor and co-founder of Hearscreen (Pty) Ltd, which offers innovative smart solutions for healthy hearing, presented the group's research and inventions. He aptly quoted Helen Keller by stating that "blindness separates people from things, and deafness separates people from people". According to the group's research, hearing loss is an invisible epidemic that affects approximately 360 million people in sub-Saharan Africa. The group's research helped to develop the hearing test app, HearZA, which was launched in March 2016.

This was followed by a presentation by Chyreen Truluck, a patent attorney and associate at Spoor & Fisher, who specialises in domestic and international patent matters, particularly in the field of biotechnology and life sciences. She delivered an extensive talk on IP law, covering the various forms of IP with real-life examples to illustrate that IP is a tool for improving lives.

The event was quite interactive, as guests had the opportunity to engage with the experts through questions and comments. Advocate Lawrence Baloyi, Head of Contract Research and Innovation in the Department of Research and Innovation, also played an active role in this regard by debunking persistent myths people have about IP. Advocate Baloyi further invited people to attend more of the IP events and seminars presented by the University in order to become more informed about IP, to see what is being invented, and to explore how the TTO operates.

World IP Day celebrates creativity, and the contribution made by creators and innovators to the development of societies across the globe.



Dr Herman Myburgh during his presentation on his research group's work.

Chyreen Truluck during her presentation on matters related to IP law.

Positioning inventions on the international stage

The central theme of UP's research strategy is to position locally relevant research on the international stage and to increase its visibility and impact at all levels. In an effort to showcase promising UP-created technologies to the international community and to build valuable networks with other technology transfer professionals, Refilwe Ngoato, Manager of the TTO, attended two important networking events in China.

Refilwe Ngoato (right) and Dr Ashley Stevens, former President of the Association of University Technology Managers (AUTM), at the Conference on International Exchange of Professionals (CIEP).

During Refilwe's first trip from 1 to 23 November 2016, she attended a course entitled "International Technology Transfer Innovation Talents Training in the Process of New Industrialisation". The presenters of the course included some of the most experienced technology transfer professionals in the world. Among these were Dr Andy Sierakowski from Australia, the Chairperson of the International Technology Transfer Network (ITTN), and Prof Ling Loerchner from the USA, the Associate Director of Commercialisation at the University of Waterloo in Ontario, Canada. Refilwe regularly contacts them for advice with regard to challenging technology transfer cases.

As part of the course, Refilwe visited seven Chinese institutions. In Fuzhou, she went on a culture tour and visited the National Cross-strait Technology Transfer Centre. At the University of Shangai, she attended lectures on innovation and technology transfer, innovation and cooperation, as well as registration laws relating to medical devices in different countries. She also attended the Global Innovation Summit in Nanjing, and attended technology matchmaking sessions in both Nanjing and the city of Zhengzhou.

In Beijing, Refilwe attended a three-day Registered Technology Transfer Professionals (RTTP) course, which covered topics such as the value chain of innovation commercialisation, technology transfer and start-up development, as well as fundraising and how to make money from IP. At the 2016 China International Technology Transfer Convention in Shijiazhuang, Refilwe presented the fast pyrolysis of biomass project and Mabu casing soil during the energy-saving and environmental protection session. Both of these are UP-created technologies that attracted much attention from potential licensees.

The fast pyrolysis project consists of a scalable pyrolysis unit for the recovery of char; a catalytic system to provide stable, usable heating oil and the hydrogenation of the heating oil to form oil that can act as a drop-in transport fuel. Mabu casing soil is a revolutionary casing soil for growing button mushrooms that does not rely on scarce peat soil from aquatic bog environments or wetlands.

During the second trip, which took place from 14 to 17 April 2017, Refilwe presented one invention at the 15th Conference on International Exchange of Professionals (CIEP) International Technology Transfer and Innovation Collaboration Session in Shenzhen.

During the conference, she presented an immunodiagnostic test for tuberculosis, which relates to a method of detecting active tuberculosis (TB). The method entails detecting surrogate markers for active TB in a serum sample containing serum mycolic acid and serum mycolic acid antibodies arising from mycobacterial infection. It is a point-of-care TB diagnostic device that is based on a known analytical technique. It uses a novel gene domain and works like a pregnancy test kit, but it is blood based. The inventor is Prof Jan Verschoor of UP's Department of Biochemistry.

Refilwe's visits included conferences, technology transfer cooperation sessions, and visits to start-up companies and incubators. She notes that these visits were important networking opportunities and it was beneficial to learn from technology transfer professionals from all over the world. A strong professional network such as the one established during her visits enables these professionals to assist one another whenever they come across technology transfer challenges.

Tanzanian delegates visit UP's TTO

The Department of Science and Technology (DST) Africa bilateral cooperation, in conjunction with the National Intellectual Property Management Office (NIPMO) and other partners, hosted a group of researchers, research managers and government personnel from Tanzania from 24 to 29 July 2017. The DST identified UP's TTO as one of the relevant hosts for a visit by the delegation.

The 12 representatives from Tanzania were hosted by the TTO at UP on 25 July 2017.

The delegates were from the National Institute for Medical Research, the University of Dar es Salaam, Muhimbili University of Health and Allied Sciences, Sokoine University of Agriculture, the Ministry of Education, Science and Technology, the Tanzania Commission for Science and Technology (COSTECH) and the Business Registrations and Licensing Agency (BRELA).

The delegation was on a fact-finding mission at the TTO and the Department of Research and Innovation (DRI) at UP. Three representatives from NIPMO and one representative from DST accompanied the delegation.

Dr Mavis Nyatlo, former Director of Advisory Support for NIPMO, welcomed the guests and gave an introduction on the purpose of the visit. Dr Nthabiseng Taole, Director of the Department of Research and Innovation, Advocate Lawrence Baloyi, Head of Contract Research and Innovation, and Refilwe Ngoato, Manager of the TTO, delivered presentations on the DRI, IP, the Innovation Division, and the TTO's work and developments respectively.

Members of the Tanzanian delegation, along with UP representatives, during their visit to the TTO on UP's Hatfield Campus.

The Tanzanian delegation comprised the following members:

- Dr Bakari Msangi – Director for Life Science (COSTECH)
- Dr Georges Shemdoe – Principal Research Officer (COSTECH)
- Dr William Kindeketa – Research Officer: Natural Resources (COSTECH)
- Judith Kadege – IP Research Advisor (COSTECH)
- Tabitha Etutu – Engineer (Ministry of Education, Science and Technology)
- Loy Mhando – Acting Deputy Registrar: IP (BRELA)
- Dr Paul Kazyoba (National Institute for Medical Research)
- Dr Eliangiringa Kaale (Muhimbili University of Health and Allied Sciences)
- Prof Robinson Mdegela (Sokoine University of Agriculture)
- Dr Donatha Tibuhwa (University of Dar es Salaam)
- Dr Amos Nungu – Assistant Director: Research and Development (Ministry of Education, Science and Technology)

Innovation Revolution

The 10th Innovation Summit took place at the Cape Town Stadium from 6 to 8 September 2017. This annual flagship event on the South African innovation calendar celebrated its 10-year anniversary with the theme Innovation Revolution. The Innovation Summit is a platform for nurturing, developing and showcasing African innovation, as well as facilitating innovation thought leadership.

The summit was created to support and promote innovation and to facilitate collaboration within its own ecosystem. This platform unites corporates, thought leaders, inventors, entrepreneurs, academia and policy makers to strengthen South Africa's renowned competitive edge, and to deliberately inspire sustained economic growth across the continent of Africa. It also provides a platform where tech entrepreneurs and innovators can participate, grow their expertise and connections, and make their ideas come to life. With the rapid advent of the industrial 4.0 tech revolution, adapting to integration and speed to market are becoming crucial.

TTO Manager, Refilwe Ngoato, attended the event, showcasing two UP-created inventions. Ryno Pretorius and Prof Henrietta de Kock exhibited at the summit.

Ryno's invention, "copper production", was shortlisted for the Inventors' Garage competition, and a range of prominent figures visited his stand. These included former Vice-Chancellor and Principal of UP, Prof Calie Pistorius, and Director of Innovation and Technology of the Department of Trade and Industry (the dti), Nontombi Marule. Ryno's invention received second place and he won a R10 000 voucher from Adams & Adams for legal fees. On 5 May 2017, the University filed a patent cooperaton treaty (PCT) application for his continuous metal electrolysis device, focusing specifically on copper production.

Prof De Kock, from UP's Department of Food Science, received an award for Distinguished Woman Researcher: Research and Innovation at the Women in Science Awards (WISA) on 17 August 2017. She is the co-inventor of the immobilised protein for scavenging flavour compounds and packaging material (SA complete patent application).

She represented NEPAD-BioFISA at the summit as a project leader for the HEALTHY SMA²RT snacks, which are made from climate-smart crops. Southern Africa's burgeoning cities, with their growing numbers of young people with a disposable income, have created a demand for safe, healthy, market-ready, ready-to-eat, African snacks. The project involves the commercialisation of research outputs related to sorghum products and the development of entrepreneurship skills at UP, the National University of Lesotho and Botswana University of Natural and Agricultural Resources.

About BioFISA

BioFISA is a Finnish-Southern African partnership programme to strengthen the New Partnership for Africa's Development-Southern Africa Network for Biosciences (NEPAD-SANBio) network. BioFISA II is a four-year programme that was launched in 2015 and supports SANBio in the impact areas of health and nutrition by creating an effective and dynamic regional research network.

The HEALTHY SMA²RT snacks were exhibited at the summit.

Visitors to Ryno's stand. Photograph left: Former Vice-Chancellor and Principal of UP, Prof Calie Pistorius (standing left). Photograph above: Director of Innovation and Technology of the dti, Nontombi Marule (far right).

The Innovation Bridge 2017

The Innovation Bridge is one of the avenues UP's TTO uses to expose the University's IP to potential investors. The Innovation Bridge technology showcase and matchmaking event takes place every second year. Innovation Bridge 2017 took place at the Gallagher Convention Centre in Johannesburg on 15 September 2017.

The event is an initiative of the Department of Science and Technology (DST), in conjunction with the Technology Innovation Agency (TIA) and the National Intellectual Property Management Office (NIPMO). It is aimed at facilitating connections and networking between South African and international innovators, industry, and public and private technology development and commercialisation funding partners.

This event also aims to encourage and accelerate the utilisation and commercialisation of existing and new knowledge and technologies that have been developed in publicly funded South African research and technology development institutions. This focus on publicly funded research and technology development differentiates the Innovation Bridge from other innovation and technology conferences and exhibitions.

Pavlo Phitidis, CEO of Aurik Business Accelerator, delivered the keynote address on building successful and sustainable innovation technology businesses. This was followed by an address from Minister of Science and Technology, Naledi Pandor, on the same topic. At this year's exhibition, the TTO selected four inventions from the Faculty of Engineering, Built Environment and Information Technology for display.

Improved alkaline-activated slag composition

The improved alkaline-activated slag composition, also known as alkali slag, relates to the development of ready-to-use alkali slag cement. It can be pre-packed in bags and used as ordinal Portland cement, eradicating the use of an alkaline solution. It can also be mixed with water to produce concrete. The removal of the alkaline solution has several advantages over classic alkaline-activated slag concrete technology, where an alkaline is introduced to the concrete mixture in the form of an aqueous solution. These advantages include quality control and construction-side safety, since the aqueous solutions of alkalis that are used for activation are normally highly corrosive mediums and utilising them is hazardous. Ready-to-use alkaline slag cements can be produced by grinding together a raw slag with an alkali and required additives, if necessary. The technology readiness level of this invention is TRL5.

A sample of the alkali slag, developed by Prof Elsabé Kearsley and Maxim Kovtun.

Insect repellent composition

The insect repellent composition, also known as controlled release repellent formulations, is essentially a mosquito repellent technology for malaria control. The invention relates to controlled-release formulations of repellents based on the engineering of the interactions between the components of the repellent mixtures, particularly by forming higher boiling azeotropes to reach a constant reduced boiling point and evaporation rate of repellents. The technology was developed by Prof Walter Focke and Homa Izadi, and has a technology readiness level of TRL5.

Composite polymer fibres

The composite polymer fibres, also known as polyolefin bi-component filaments as slow release devices for liquid actives, relates to a composite polymer filament with a core containing a liquid active and an outer membrane layer that reduces the rate at which the active ingredient is released into the atmosphere. The composite filament may be used to manufacture fabrics (for example, insecticidal fabrics or mosquito-repellent fabrics). A simple melt extrusion and drawing process produced the filament. The technology readiness level of this invention is TRL6.

The composite polymer fibres have been knitted into mosquito-repellent socks and other protective wear.

Exposure for malaria sock

Mosquito-repellent socks, ankle guards and slap bands made from the composite polymer fibres were sold at the Gauteng Getaway Expo in September 2017.

Malaria alone has resulted in 214 million clinical cases and 438 000 deaths in 2015, with most cases and deaths noted in the World Health Organisation (WHO) Africa region. In addition to being exhibited at the Innovation Bridge, the malaria sock also received exposure at the Gauteng Getaway Expo held at the Ticketpro Dome from 23 to 25 September 2017. The Gauteng Getaway Expo displayed over 350 exhibits related to travel, outdoor and adventure activities.

An urgent need exists for research and surveillance in many malaria areas to eliminate malaria with the use of an integrated management approach, including safer alternatives to insecticides being used, especially those that are known for resistance. The malaria sock is a product that addresses this matter. More malaria-related research is being conducted by UP researchers from the Institute of Applied Materials (IAM) and the University of Pretoria Institute for Sustainable Malaria Control (UP ISMC). A successful example is the unique blend of two approved repellents with improved repellent efficiency, which could provide a faster route to the public use of replacement repellents.

5G technology

Nishant Singh and Piotr Osuch have contributed to innovation in 5G technology through their development of novel on-chip bandpass filters and digital signal processing blocks, as necessitated by future 5G technologies. The technology readiness level of this invention is TRL4.

Four problems that have plagued the telecommunication industry for more than 30 years are solved by the proposed technology. In this regard, the inventors have developed tuneable mm-wave (Ka – W band) on-chip bandpass filters, with characteristics similar to those achievable in traditional soft-substrates, as well as tuneable on-chip bandpass filters in the (L – X bands). The technology also eliminates receive SAW filters that prevent a true low-cost single-chip solution with high dynamic ranges, while maintaining best-in-class noise figures (NF), low-phase noise (PN) and spur performance. It provides the ability to process high bandwidth signals (10 GHz for 5G) in real time. This invention has been honoured with a range of awards.

Magic number 5G inventors keep winning

Multifractal Semiconductors SA, the company founded by postgraduate students Nishant Singh and Piotr Osuch from UP's Carl and Emily Fuchs Institute for Microelectronics (CEFIM), won the 2017 start-up Tel Aviv-South Africa competition, administered by the Embassy of Israel. The inventors of the innovative novel on-chip bandpass filters and digital signal processing blocks received an all-expenses-paid trip to Israel to participate in the Tel Aviv Digital Life Design (DLD) festival. They also met angel investors and learned from start-up ecosystem gurus in Israel.

The Tel Aviv DLD festival is Israel's largest hi-tech annual conference. Thousands of hi-tech professionals, entrepreneurs and investors from Israel and abroad converge for the prestigious international festival and conference dealing with innovation, digital media, science and culture. The conference's main objective was to lay the groundwork for future innovations and technological developments in order to create a platform for professionals and senior executives in the global hi-tech industry to exchange ideas and network. The festival boasts top technological talent, the highest venture capital investment per capita and multinational centres for industry leaders such as Amazon, Google, Yahoo, Facebook and Microsoft.

In response to the award, Nishant said, "We are so grateful to win this amazing opportunity, South Africans can benefit greatly from the Israeli ecosystem and we look forward to creating partnerships at the DLD festival in Israel and to learn from other entrepreneurs from all over the world."

Piotr added, "It's been a long journey to get to where we are today. We hope to transfer this reward to others and to continue to develop this product to make the world a better and a more connected place."

The competition has gained huge traction since it was launched four years ago, and received a record number of 170 candidates competing in the theme of "innovating to make the world a better place." Multifractal Semiconductors SA has developed complete transmission systems on a silicon chip, which will increase efficiency and throughput and will be an enabler of the huge amounts of data that will be transmitted in the future. Three invention disclosures were submitted to the TTO in 2016 and two in 2017, and the company is keen to sign a license agreement with the University.

Nishant Singh receives the 2017 start-up Tel Aviv-South Africa award on behalf of Multifractal Semiconductors SA.

5G at the GAP Awards 2017

The sixth annual Gauteng Accelerator Programme (GAP) Awards were held at the Innovation Hub during Global Entrepreneurship Week on 16 November 2017. The Innovation Hub established the GAP innovation competitions in 2011, with the aim to recognise and reward innovative ideas that have the potential to positively influence the Gauteng economy.

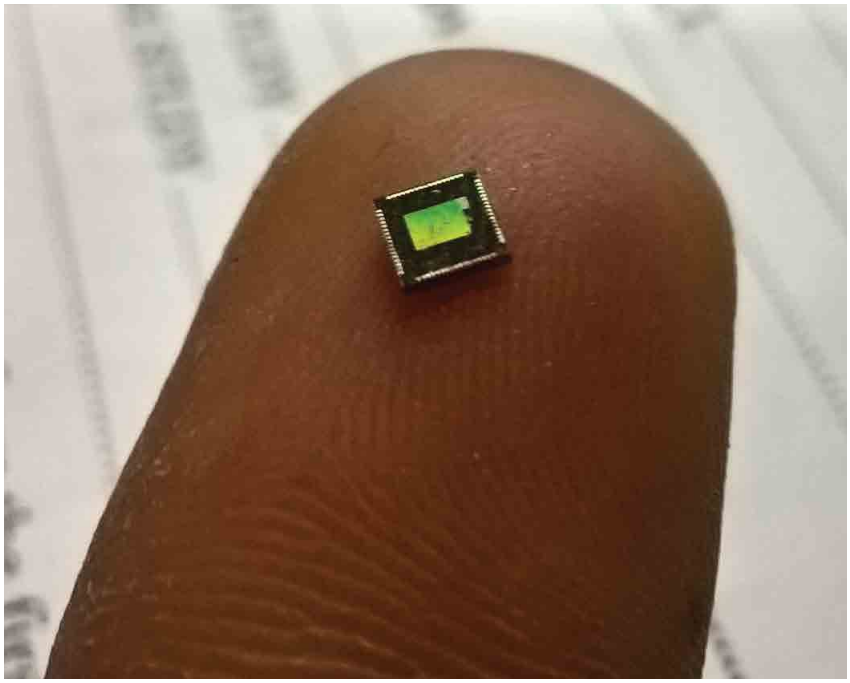
GAP seeks out innovators, researchers and entrepreneurs who are working on novel ideas that will advance the efficiency of government service delivery, create competition in the local economy and enrich the quality of life of ordinary citizens.

Award categories comprise information and communication technologies (ICT), medical, biosciences, green economy and township economy. These categories have attracted more than 1 500 entries, and GAP has invested over R10 million in seed funding and incubation support to over 55 start-ups since its inception in 2011.

Nishant Singh was selected as one of eight finalists in the ICT category, and Multifractal Semiconductors SA walked away as one of four category winners. This comes after the company flew the South African innovation flag high in Israel at the Tel Aviv DLD festival.

GAP ICT, in collaboration with mLab Southern Africa and Intel, identifies researchers and entrepreneurs working on ICT-based solutions to South Africa's biggest challenges. These range from Internet of Things (IOT) and artificial intelligence to mobile applications used in education. An independent panel of judges considers business strategy, technology, market, the team and the impact of the technology when selecting the winners.

The top four share R600 000 milestone-tied business development money, where R265 000 goes to the first-place recipient, R195 000 to the second place, R130 000 to the third place and R65 000 to the fourth place.



Multifractal Semiconductors SA has developed enabling technologies for single-chip low-cost high-bandwidth millimetre-wave wireless telecommunications systems such as 5G cellular.

Acting MEC of the Department of Economic Development, Agriculture and Rural Development, Faith Mazibuko, also attended the gala dinner event. The MEC said: "We are excited about the innovations and the calibre of the winners that came out of this year's GAP innovation competitions. We are looking forward to taking this innovation forward to improve service delivery in government and the private sector."

The other winners in the ICT category comprise a cloud-based platform that allows job seekers to SMS their CVs without internet, called Ejoobi, a controlled environment agriculture systems manufacturer called MCX Technologies, and a smart IOT floater linked to an app for pool maintenance called ProAutomation PoolSense.

McLean Sibanda, CEO of the Innovation Hub, announced that the winners will be incubated at the Innovation Hub's Maxum Business Incubator and will receive specialist product development support from the Climate Innovation Centre, mLab, BioPark and the eKasiLabs facilities located in the townships.

Nishant Singh received one of four awards in the ICT category of the 2017 GAP Awards on behalf on Multifractal Semiconductors SA.

http://www.multifractal.org/

SA to host 2018 ITU – thanks to Motswadi app

UP's TTO facilitates the transfer of UP-created discoveries into new products and services for the benefit of the public. It aims to promote regional economic growth and job creation, generate net royalty income for the TTO, its inventors and the University, as well as create, foster and develop new relationships with industry.

One innovator that is always on the go and continues to develop new relationships (when not inventing new apps) is the award-winning inventor Khutso Bapela. This inventor of the acclaimed Motswadi app has been travelling the globe to foster new business relationships.

Khutso is a BSc Computer Science graduate from UP who successfully developed an anti-cyber bullying app that is aimed at helping the parents of young children in all South African communities to monitor their children's online activities in an attempt to prevent continuous unsurfaced cyber bullying.

Khutso Bapela

On 29 January 2016, the Royal Academy of Engineering in London invited Khutso to join the leaders in innovation fellowship. Following this achievement, the Academy invited him as a designated guest and judge for entrepreneur awards in Kenya, Nairobi, on 21 May 2017, where he could share his experiences with other entrepreneurs.

Khutso also travelled to the USA to pitch the Motswadi system to a panel of judges as part of a selection process into the Google Business Development Program in San Francisco, California, on 3 June 2017. The Motswadi system emerged as a winner. This programme allows the most innovative entrepreneurs access to office space, funding and networking opportunities in the USA.

In August 2017, Khutso was in Abu Dhabi in the United Arab Emirates (UAE) to negotiate expanding the Motswadi system's interest in the Middle East through the UAE's top network provider, Etisalat. Following this effort, he managed to seal a pre-commercialisation agreement that allows Etisalat to pilot the product on its platform. Should the pilot be a success, the Motswadi app will be sold through Etisalat as a main partner in the Middle East and Africa in exchange for profit sharing.

Most recently, the Ministry of Telecommunication and Postal Services invited Khutso to represent South African ICT innovations at the prestigious event of the International Telecommunication Union (ITU), which was held in Busan, South Korea on 22 September 2017. This was also part of South Africa's bid to host the 2018 ITU conference in Durban. The Motswadi system was shortlisted among the world's top innovations to participate in the SME global awards. Even though it did not win this highly competitive award, its participation was instrumental in South Africa successfully winning the bid to host the 2018 ITU conference.

BSMARD

Khutso's latest invention, the BIIS smart devices (BSMARD), is a smart wallet with a capacity to store more than 1.5 million cards (for example, business cards, credit cards, drivers' licence or tickets) in one smart device. Where traditional wallets accommodate a limited number of cards, BSMARD allows one to have all one's virtual cards in a slim smartphone-like device.

The device uses a biometric security system to access information, and users can remotely erase information on the device in case of theft. It also uses near field communication (NFC) for the payment of bus tickets and groceries at retail stores, and users can share contacts using Wi-Fi Direct. The device is under a patenting process through UP. The company is based at the Innovation Hub. Remote offices were secured in Dubai and San Francisco through entrepreneur programmes.

TuksNovation: addressing unemployment in South Africa

A recently published article in the *Times* newspaper reports that five Southern African countries (Botswana, Lesotho, Namibia, Swaziland and South Africa) have higher unemployment rates than countries at war such as Iraq, Libya and Yemen. These Southern Africa Customs Union (SACU) countries are among the world's top 20 countries for their high unemployment rates.

According to economist Mike Schussler, South Africa has had an unemployment rate higher than 20% for more than two decades. Based on a report in *Trading Economics* (2017), the unemployment rate for youth, including university graduates, is extremely high at 55.9%. UP is aware of this challenge and plans to establish a high-tech business incubator and accelerator in the Faculty of Engineering, Built Environment and Information Technology (EBIT).

TuksNovation, the business technology incubator, is set to promote job creation by supporting the commercialisation of technology, networking, mentoring and establishing sustainable spin-off technology companies.

Universities play a major role in regional socio-economic development, especially in a knowledge-driven economy. Innovations arising from a university's intellectual capital can stimulate economies through new product development. This is why universities are highly valued in terms of economic potential.

The low success rate of universities involved in spin-offs as a way to promote socio-economic development can be attributed to the absence of an entrepreneurial culture, limited access to funding, as well as technology transfer offices at universities with inadequate critical skills and capacity.

Over the long term, the business incubator aims to enable the development of industrial clusters with a positive economic impact in Tshwane in partnership with the Department of Small Business Development's Small Enterprise Development Association (SEDA).

According to Prof Elma van der Lingen, Chairperson of UP's Graduate School of Technology Management (GSTM), the TuksNovation model is based on allocating seed funding to students who are keen to become entrepreneurs and are conducting research on projects that have the potential to develop into commercially viable technology.

The technology development phase of the projects will be piloted in a virtual incubator in the University's laboratories and at facilities at local industries. The students will receive expert technical guidance from academics at the University, as well as technological entrepreneurship training. Initially, TuksNovation will support the development of spin-offs in the Faculty of Engineering, Built Environment and Information Technology.

However, based on the availability of funding, it will possibly expand to other faculties involved in science and technology at the University as well.

Members of the TuksNovation Board of Directors (from left): Mr Horst Weinert (SEDA), Adv Lawrence Baloyi (UP's Department of Research and Innovation), Prof Sunil Maharaj (Chairperson and Dean of EBIT), Mr Naeem Moolla (UP Finance Department), Prof Elma van der Lingen (GSTM) and Dr Elmar de Wet (Enterprises UP).

Blade-tip timing wins Eskom award

Eskom's investment committee has approved a R15 million research and development (R&D) project to develop a rotor blade condition monitoring system. The prior IP, which emanates from Dr Dawie Diamond's PhD research, is the cardinal foreground IP around which this project will be built. This year, the TTO filed three patent cooperation treaty (PCT) applications for the technology.

Blade-tip timing is used to monitor blade vibration and uses probes of various designs to detect the arrival time of individual rotor blades at a number of points around the rotor casing. This technique forms part of several online, non-intrusive condition-monitoring techniques that focus on vibration signals or pressure fluctuations, which are observed in turbine blade testing.

UP PhD graduate in Mechanical and Aeronautical Engineering, Dr Diamond, developed the new statistical signal-processing technique for blade-tip timing measurements between 2013 and 2015. He used the blade-timing approach in his analysis of the synchronous vibration of turbine blades during a constant turbine shaft speed. Dr Diamond explains that this vibration is one of several vibration conditions of turbomachinery, which can include flutter, that occurs when there is aerodynamic instability and synchronous vibration.

"This statistical technique is based on Bayesian statistics (a system for describing epistemological uncertainty using the mathematical language of probability) that calculates the probability that a blade is in resonance, or vibrating, at one of its natural frequencies. According to Dr Diamond, it determines the size of the vibration in a probabilistic manner. By determining the size of the vibration, technicians can determine whether the blade is being excessively damaged, as well as the remaining blade life cycles.

Dr Diamond adds that the technique was successfully used in the Sasol laboratory from July to November 2014, with several recorded and verified successes on a laboratory-scale turbomachine blade-vibration test setup.

He also acknowledges the challenges in testing practicalities, which can only be verified on industry-sized and applied turbomachinery; hence, the drive for access to industry turbines to conduct active field research and complete the technique's methodologies.

The research has developed to the point where the researchers believe they have a solution, in collaboration with industry partners, to make it commercially feasible.

New TIA seed-funded projects

With support from the Department of Science and Technology (DST), the Technology Innovation Agency (TIA) develops and nurtures technological innovation in order to improve economic growth in South Africa. TIA administers a Seed Fund, which the agency launched in 2013, that offers entrepreneurs and innovators grant funding of between R500 000 and R650 000 per project. The fund channels seed funding through technology transfer centres at universities, such as UP's TTO, and science centres to innovative projects, as well as through small business support organisations in provinces to entrepreneurs.

According to the TIA annual report for 2016/17, the Fund has lent out R74 million to 133 projects. Several of these projects are from UP.

The following inventors and projects were awarded funding in the first round of awards in February 2017:

- Daniella Twilley and Prof Namrita Lall's development of chemo preventive sunscreens from South African plants for the prevention of skin cancer
- Prof Elna Buys's flavour-scavenging polymeric packaging
- Prof Nico Labuschagne's phosphate solubilising bio fertilizer
- Patrik Manditereza and Prof Ramesh Bansal's product design and development: distributed differential fault detection and identification protection relay for the DG-integrated distribution system

The second round of awards took place in November 2017. Funding was awarded to Prof Don Cowan for his project on the exploitation of a novel bacterial gene for increasing stress tolerance in economic crop plants, and to Prof Robert Millar for his project on GnRH analog-estrogen conjugates as novel drugs for prostate cancer.

TTO Chuma Commercialisation Programme

TIA, the British Council and the UK Newton Fund have collaborated on a programme to develop a group of early-career researchers and innovators who are able to bridge the research-to-commercialisation gap.

This is done by equipping researchers with the tools, resources and experience needed to achieve the goal of growing the economy by becoming more competitive in research and innovation on an international level.

The programme aims to address the lack of capacity with respect to experienced and skilled individuals in the National System of Innovation (NSI) in South Africa and sub-Saharan African countries by building capacity within the sector.

The key objective of the programme is to develop scientists and engineers who are capable of facilitating the process of commercialising technology (innovation) that has been researched and developed in the public sector.

Through professional development and engagement, TIA has invited proposals from various entities or institutions to host candidates participating in its UK Newton Fund programme.

Athenkosi Matshini, one of the current candidates for this programme, has been with the TIA Chuma Commercialisation Programme since April 2016. His tenure will end in March 2018. He has been with the UP TTO since July 2016.

From 18 to 25 November 2017, Athenkosi, along with other Chuma candidates, visited four higher education institutions in the UK: Swansea University, Cardiff University, Cardiff Metropolitan University and South Wales University. The aim of the visits was to apply all the training, mentoring and experience the Chuma candidates had gained so far, and to provide them with exposure on how technology transfer offices operate in the UK. The visit also highlighted alternative funding models that the TTO can implement in raising funds and pitching business ideas to venture capitalists and angel investors.

The mission of the programme is to strengthen the technology innovation sector by developing the capacity of science, technology, engineering, maths and innovation researchers and graduates in technology commercialisation by building capacity to complete the innovation cycle or ecosystem from research to commercialisation. It also seeks to provide an alternative career path for unemployed graduates in the science and engineering fields.

Some of the deliverables that UP rendered included mentorship and internship at the TTO, and making the TTO available as office workspace for the candidate.

Converting solar energy into electricity

An invention that will harness energy from the sun has attracted the attention of the TIA, which provided funding for the development of a prototype small-scale dish-mounted solar thermal Brayton cycle.

This invention is the brainchild of Dr Willem le Roux, who designed, constructed and tested the initial version of the device as part of his PhD study in 2014. The idea was for it to power homes in off-the-grid and water-scarce areas in South Africa, but he now believes that it may even be able to be used in industrial applications.

The device makes use of a sun-tracking dish reflector, solar receiver, recuperator and micro-turbine to generate power in the range of 1–20 kW. The parabolic dish reflects and concentrates the sun's rays onto the receiver aperture so that the solar heat can be absorbed by the inner walls of the receiver. The heat is transferred to air as the working fluid, which makes this cycle particularly attractive in arid countries such as South Africa. In the recuperator, hot turbine exhaust air is used to preheat compressed air before it enters the receiver. The compressed and heated air then expands in the turbine, which produces rotational shaft power for the compressor and the electric load. The compressor, turbine and generator are mounted on a single shaft, and all spin at the same rate. It is simple, robust and easy to maintain.

The prototype is currently being constructed on the roof of the University's Engineering II Building, and Dr Le Roux, who has since joined the University as a lecturer, is supervising ongoing research related to the device, such as upgrading the dish and tracking system, which will contribute to its further development and eventual commercialisation.

The prototype of Dr Le Roux's invention is currently being constructed on the roof of the University's Engineering II Building.

According to Dr Le Roux, the concept of getting free energy from the sun fascinated him, and he decided to focus on the idea of using air as a working fluid to generate heat rather than water. This was the inspiration for his PhD research, which aimed to convert solar energy into electricity through a micro-turbine.

He says that this system provides several advantages over photovoltaic (PV) systems (solar panels) and other concentrating solar power (CSP) plants, such as the heliostat field being built in the Northern Cape. Although the system is more expensive than solar panels, it offers much greater solar-to-electrical efficiency, as it boasts a conversion rate of around 30%, compared to 10% to 15% for solar panels.

Ultimately, the system will be able to function as a small-scale hybrid system that can heat water with the heated air in addition to generating electricity. The system will also be able to function around the clock as gas can be used to power the turbine, which makes it ideal for use in isolated rural communities that do not have easy access to the national grid.

Ongoing work related to the development of the device and developing components to optimise its functioning may deliver new inventions that could evolve into potential patents.

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