FLUID THOUGHTS

Tackling the national innovation challenge to attract investment

The 26 April was World Intellectual Property Day. It's a day of some controversy around the world, and, depending on whether you are a beneficiary or victim of the current global patterns of production and consumption, the day becomes one of hope or one of continued despair. This is based on an age-old discourse that has at its centre the notion of intellectual property rights as both a trade barrier as well as a barrier to localisation and development.

This is an argument worth revisiting frequently as we observe significant changes in the global economic power balances. The rise of China and India in particular has created a slipstream for many developing countries who have responded quite positively. There is a close correlation between the creation of new intellectual property and innovation. An examination of the 2017 Global Innovation Index (GII 2017), compiled by the World Intellectual Property Organisation (WIPO) and its partners, indicates an increasing presence of African countries. South Africa tops the African list coming in at 57th, followed by Mauritius at 64th and Kenya at 80th. But the top end of the list is dominated by high-income, developed countries with 24 of the top 25 in this category. The exception is middle-income China which came in at 22nd. Can South Africa follow in China's footsteps into the top 25?

A closer examination of African development using innovation as a metric makes for interesting study. Many punters agree that developments in ICT and the 4th Industrial Revolution will shape the competitiveness indices going into the future. The World Telecommunication Union's ICT Development Index (WTU IDI) paints an interesting picture with Mauritius topping the African list followed by the Seychelles. South Africa follows only in third place and only one place ahead of Cape Verde with our neighbour Botswana being in 5th position on the continent.

This begins to answer an important question. Why did South Africa come out at 61st out of 137 countries measured in the 2017-18 Global Competitiveness Report from the World Economic Forum? A drop of 14 places from 47th in the previous round. It is an economy that appears to rely on old strengths with mainstays in primary resources and agricultural production.



WRC CEO, Dhesigen Naidoo

The fast-upward movers are investing in innovation and the infrastructure to enable a knowledge-based economy. So, while South Africa's general infrastructure ranks 46th in the GII 2017, its ICT infrastructure only ranks 78th.

Even more worrying is that fact that while South Africa ranks highly in market sophistication at 21st on the list, its business sophistication at 57th fails to take advantage of this, which goes some way to explain why South Africa is a high import economy. This is exacerbated by the fact that South Africa's knowledge and technology output ranking is a low 65th. An examination of the pipeline shows the following, in spite of a very high investment in education – ranked 20th on the basis of percentage GDP spend on education, the education performance places the country at 75th in the rankings with tertiary education even lower with South Africa in 89th place. Thus, in spite of the fact the South Africa's research and development ranks at 39th, the resultant ranking in the knowledge worker category for the country is only 67th. The knowledge worker capacity and capability remain the absolute key to innovation and global competitiveness.

Another part of the broken telephone reads as follows: South Africa's research and development ranking is a credible 39th – not too far off the leading pack, but this achievement is not optimally realising knowledge creation (ranked only 52nd), which translates quite poorly in the domain of knowledge diffusion (ranked 63rd) that then finds an even more difficult journey into knowledge impact, the latter ranked at 84th in the world. This means that while the country, through both the public and private sectors, is managing to keep the research and development investment and performance at a reasonable level, an uncoordinated National System of Innovation is failing to translate this investment through the creation of new knowledge and intellectual property into the knowledge-based impact that is required for higher levels of economic growth and social wellbeing.

The remedies have been worked through. The National Advisory Council on Innovation (NACI) has submitted to the Minister of Science and Technology a candid review on the performance of the NSI and recommendations for major changes. The minister,

Upfront

in turn, is steering a process to development a new White Paper on Science, Technology and Innovation to create a functional and productive innovation ecosystem in the country. Individual institutions like the Water Research Commission (WRC) are busy putting more effort into building bridges with sister institutions like the Technology Innovation Agency (TIA) and other public and private partners to translate the research and development investment into real dividend. It does require higher levels of innovation investment and broader partnerships like the promising Creative Leadership Collective Africa (CLC Africa) – an expanding team of innovation leaders in public institutions and private companies developing a new innovation narrative for the country.

The bottom line is that an innovative and higher technologically capable South Africa, boasting a strong knowledge worker base, will be a magnet for the \$100 billion that is the first target for foreign direct investment in President Cyril Ramaphosa's plan. But it has to be leveraged with an internal investment to create the conditions necessary for the courting to be successful and productive.



WATER DIARY

Aquatic science June 24-28

The Southern African Society of Aquatic Scientists will be holding its 2018 congress in Cape St Francis Bay resort, in the Eastern Cape. The theme for the congress is 'Aquatic ecology in the Anthropocene'. Enquiries: Petrie Vogel (conference organiser); Tel: (12) 346-0687; Email: admin@savetcon.co.za; **Visit: www.savetcon.co.za**

Water resource management June 24-27

The Water Institute of Southern Africa (WISA) is hosting its biennial conference at the Cape Town International Convention Centre. **Visit: www.wisa2018.org.za**

Large dams July 1-7

The 26th Congress of the International Committee on Large Dams (ICOLD) will take place in Vienna, Austria. Visit: www.icoldaustria2018.com

World water week August 26-31

World Water Week is the annual focal point for the globe's water issues. It is organised by the Stockholm International Water Institute. The theme is 'Water, ecosystems and human development'. Visit: http://www.worldwaterweek.org/

Wetlands October 8-11

The National Wetlands Indaba will take place at the Mittah Seperepere Convention Centre, in Kimberley, Northern Cape. The theme of the conference is 'Drylands and wetlands: connecting and managing heterogeneity across landscapes'. **Visit:**

VISIT:

www.nationalwetlandsindaba2018.com

Municipal engineering October 31-November 2

The annual conference of the Institute of Municipal Engineering of Southern Africa will be held in Port Elizabeth with the theme, 'Innovative infrastructure solutions'. **Visit: www.imesa.org.za.**

Irrigation engineering November 13-15

The South African National Committee on Irrigation and Drainage (SANCID) will be holding its 2018 conference with the theme 'Opportunities to management climate change'. The conference will be held in White River, Mpumalanga. **Visit: www.sancid.org.za**

NEWS

Web app help users to save water



Global firm of engineers and scientists SRK Consulting has long been in the business of helping clients manage their water sustainably; now it has brought water saving closer to home with an innovative web app that can get individuals to reduce their domestic water use – introducing fun and competition to the exercise. The brainchild of two young colleagues – environmental and civil engineer Xanthe Adams in Cape Town and civil engineer Whelan Naidoo in Johannesburg – WaterWar is an app that goes beyond just calculating water use; it uses peer pressure as a motivator for saving water. The app allows people and companies to compete with each other, while keeping the interface simple and easy to use.

"The idea was to get people interested and engaged by playing a game – so our concept is really a combination of water sciences, programming and psychology," said Adams. "To work as a game, the output needed to be comparable between users; we settled on the calculation of litres used per person per day, based on the household water bill."

The developers also realised that the data input needed to be quick and easy,

and therefore based the calculation on how many people live in the household. If users want to get into more detail a few other simple variables – such as the duration of showers, half-flush toilets and dishwasher cycles – can be input.

"Input take the user less than five minutes, and can all be seen on one page with an immediate result," noted Adams.

Competition between the SRK branches using the app saw an 8% decrease in water use over six months. The Cape Town group has saved over 1 730 kilolitres since they started using the app in 2016.

For more information about the app, Visit: www.waterwars.co.za/

Work underway to replace school pit latrine backlog

The Department of Basic Education (DBE) says judgement in the Michael Komape case, ordering the department to replace all pit toilets in Limpopo, comes as work is already underway to fast track sanitation infrastructure.

Michael Komape lost his life at the age of five when he fell into a pit latrine at his primary school. On 23 April, Judge Gerrit Muller handed down judgement in the Limpopo High Court in Polokwane.

"This judgement comes at a time when, as the Department of Basic Education, we are seized with the matter of school infrastructure and pit latrines, particular as per President Cyril Ramaphosa's directive that addressing sanitation infrastructure backlogs must be accelerated.

"As a result, an audit of all school toilets is currently underway in all provinces and a comprehensive costed plan will be given to the President for consideration within the set timelines," said the department in a statement.

Following the death of five-year-old Lumka Mkhethwa of Luna Primary School in Bizana, Eastern Cape, who met the same fate as Michael last year, President Ramaphosa issued a directive to the department to urgently address the sanitation infrastructure backlog.

Judge Muller dismissed the R3 million financial compensation claims of the family but ordered the Limpopo Education Department and the DBE to replace all pit toilets in rural Limpopo schools. The order will be under the supervision of the court. The judge said getting the department to replace all pit latrines in the province is more beneficial to all learners than the awarding of compensation on constitutional grounds to one family.

Source: www.sanews.gov.za

African biodiversity and ecosystem services in decline – report



The world's first comprehensive, evidence-based regional assessment of biodiversity and ecosystem services for Africa compiled by over 100 experts across 45 countries has been completed.

The governments of 129 member nations approved the report at the sixth session of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in Colombia earlier this year. The objective of the IPBES, established in 2012, is to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human wellbeing and sustainable development.

"Africa's immense natural resources and its diverse cultural heritage are among its most important strategic assets for both human development and well-being." This is according to CSIR chief scientist, Dr Emma Archer, who co-chairs the African Assessment along with Dr Luthando Dziba of South African National Parks and Prof Kalemani Joseph Mulongoy of the Democratic Republic of Congo.

"Today there are more African plants, fish, amphibians, reptiles, birds, and large mammals threatened than ever before by a range of both human-induced and natural causes," noted Dr Archer.

The African Assessment report is one of four regional assessments of biodiversity and ecosystem services. The other three

assessments cover the Americas, Asia and the Pacific as well as Europe and Central Asia. The assessment reports point to a decline in biodiversity in every region of the world, thus significantly reducing nature's capacity to contribute to human well-being.

Biodiversity and nature's capacity to contribute to people are being degraded, decreased and lost due to a number of common pressure, including climate change, overexploitation and the unsustainable use of natural resources and habitat stress, among others. However, measures taken by African governments to protect biodiversity and nature's contributions to people have contributed to some recovery of threatened species. Such measures include the establishment and effective management of protected areas and networks of wildlife corridors. as well as the reintroduction of wildlife, among others.

South African firm completes water projects for Tanzanian mine

Veolia Water Technologies South Africa has completed a three-part project for Shanta Gold in Tanzania at its New Luika Gold Mine.

The firm's scope of work incorporated fabrication, installation and commissioning of a river water treatment package plant and skid-mounted borehole water treatment plant, as well as supplying equipment for, refurbishing and commissioning an existing sewage treatment plant.

The plants were commissioned in April. Equipment fabrication was collected from the firm's premises in Johannesburg to the mine, located in south-west Tanzania.

The 30 m³/h river water treatment package plant treats water from the nearby Luika River for use as process water. The plant uses clarification with appropriate chemical dosing to ensure the clarifier operates efficiently, as well as multimedia filtration, activated carbon filtration and pre- and post-chlorination.

In turn, the 5 m³/h skid-mounted borehole water treatment plant is used as post-treatment for an existing water treatment plant. Veolia's engineered skid uses a chlorine dosing unit, carbon filter and softener to treat the water for the mine camp's potable water needs. Veolia also refurbished the existing sewage treatment works.

"As most of the plants are automated, operator training was minimal and took place simultaneously to commissioning," said Sean Momberg, Project Engineer, Engineered Systems, Veolia Water Technologies South Africa. "All equipment was manufactured on time and to spec, and even with the short lead time we completed the manufacture of the plants within the specific time limits. It took a bit longer on site to install the plants than initially expected due to the rugged and isolated area that the New Luika Gold mine is situated in, but the Shanta Gold and Veolia site teams worked together admirably to get the plants up and running in the shortest possible time."



GLOBAL

US & Dutch professors share international water prize

Professors Bruce Ritmann and Mark van Loosdrecht have been named the 2018 Stockholm Water Prize Laureates for revolutionising water and wastewater treatment.

By revolutionising microbiologicalbased technologies in water and wastewater treatment, the professors have demonstrated the possibilities to remove harmful contaminants from water, cut wastewater treatment costs, reduce energy consumption, and even recover chemicals and nutrients for recycling.

Their pioneering research and innovations have led to a new generation of energyefficient water treatment processes that can effectively extract nutrients and other chemicals – both valuable and harmful – from wastewater.

Mark van Loosdrecht is Professor in Environmental Biotechnology at Delft University of Technology, in the Netherlands. Bruce Rittmann is Regents' Professor of Environmental Engineering and Director of the Biodesign Swette Centre for Environmental Biotechnology at the Biodesign Institute, Arizona State University, in the US.

In its citation, the Stockholm Water Prize Nominating Committee recognised Profs Ritmann and van Loosdrecht for "pioneering and leading the development of environmental biotechnology-based processes for water and wastewater treatment. They have revolutionised treatment of water for safe drinking, and refined purification of polluted water for release or reuse – all while minimising the energy footprint."

The professors' research has led to new processes for wastewater treatment currently being used around the globe. "Traditionally, we have just thought of pollutants as something to get rid of, now we're beginning to see them as potential resources that are just in the wrong place," noted Prof Rittmann. "We're in the middle of a paradigm shift, with more and more focus on how we can create resources, using microbial systems."

Historic agreement signed to protect the world's largest tropical peatland

In an unprecedented move to protect the Cuvette Centrale region in the Congo basin, the world's largest tropical peatlands, from unregulated land use and prevent its drainage and degradation, the Democratic of Congo, the Republic of Congo and Indonesia jointly signed the Brazzaville declaration that promotes better management and conservation of this globally important carbon store.

There is a lot at stake in the protection of these peatlands: the equivalent of three years of global greenhouse gas emissions are stored in the Congo basin, emissions that could be released if the peatlands are degraded or the natural wetlands drained.

To preserve the future of these valuable natural peatlands – which are about the

size of England, and were only mapped scientifically in their entirety for the first time last year – the DRC and the Republic of Congo established a transboundary collaboration agreement. The agreement noted the importance of good land use and infrastructure planning that takes the nature of peatlands into account.

"Conservation and development can go hand in hand," said Erik Solheim, Head of UN Environment. "We will manage to conserve the peatlands if we put people's needs first. We can help countries to better understand the unique nature of the peatlands, and plan very carefully for any potential use.

Peatlands are wetlands that contain a mixture of decomposed organic material,

partially submerged in a layer of water, lacking oxygen. The complex biodiversity of the peatlands means they are home to a variety of species, but their high carbon content makes them uniquely vulnerable to incineration if they are drained. The declaration recognises the importance of the scientific breakthrough of mapping the world's largest tropical peatland area.

UN launches new global decade for action on water



The United Nations has launched a tenyear water action plan that seeks to forge new partnerships, improve cooperation and strengthen capacity to implement the 2030 Agenda for Sustainable Development.

Most directly linked to Sustainable Development Goal (SDG) 6, safe water and adequate sanitation are indispensable for healthy ecosystems, reducing poverty, and achieving inclusive growth, social well-being and sustainable livelihoods – the targets for many of the 17 Goals. However, growing demands, poor management and climate change have increased water stresses and scarcity of water is a major problem in many parts of the world.

Furthermore, more than two billion people worldwide lack access to safe water and over 4.5 billion to adequate sanitation services, warned UN Secretary General António Guterres. "By 2050 at least one in four people will live in a country where the lack of freshwater will be chronic or recurrent."

Stressing that water cannot be taken for granted, the UN chief said that while solutions and technologies to improve water management exist, these are often not accessible to all. "As with most developmental challenges, women and girls suffer disproportionately. For example, women and girls in low-income countries spend some 40 billion hours a year collecting water," he noted.

The ten-year action plan hopes to place greater focus on the sustainable development and integrated management of water resources for achievement of social, economic and environmental objectives; the implementation and promotion of related programmes and projects; and the furtherance of cooperation and partnerships at all levels to achieve internationally agreed water-related goals and targets, including those in the 2030 Agenda for Sustainable Development.

To learn more about the action plan, visit: www.wateractiondecade.org

Device harvests water from desert air

Even in the most arid places on Earth, there is some moisture in the air, and a practical way to extract that moisture could be a key to survival in such bonedry locations. Now, researchers at MIT in the US have proved that such an extraction system can work.

The new device, based on a concept the team first proposed in 2017, has now been field-tested in the dry air of Tempe, Arizona, confirming the potential of the new method, though much work remains to scale up the process, the researchers say. The new work is reported in the

journal Nature Communications.

The system, based on relatively new high-surface-area materials called metalorganic frameworks (MOFs) can extract potable water from even the driest of desert air, the researchers say, with relative humidities as low as 10%. Current methods for extracting water from air require much higher levels – 100% humidity for fog-harvesting methods, and above 50% for dew-harvesting refrigeration-based systems, which also require large amounts of energy for cooling. The test device was powered by sunlight, and although it was a small proof-ofconcept device, if scaled up its output would be equivalent to more than a quarter litre of water per day per kilogram of MOF, the researchers say. With an optimal material choice, output can be as high as three times that of the current version, according to project team leader Evelyn Wang.

The next step, Wang says, is to work on scaling up the system and boosting its efficiency.

WATERWHEEL

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NEW WRC REPORTS



Groundwater sampling manual

As drought grips large parts of South Africa, the importance of groundwater as a secure source of water for domestic and agricultural needs has become clear. However, while many people think of groundwater as an unlimited resource, groundwater does have a finite limit and needs to be managed sustainably to ensure future supply. Groundwater

sampling is essential to determine and maintain the distribution of renewable groundwater resources in South Africa. There is no best single method that will suit all groundwater sampling objectives or is applicable at all sites or times. Thus, as new methods, techniques and equipment are developed, there is a need to continuously update groundwater sampling manuals. Now in its third edition, the latest groundwater sampling manual aims to provide consistent groundwater sampling techniques. **Report no. TT 733/17**



Development of an integrated water quality management framework decision support system: Pilot study in the Breede-Gouritz water management area

The aim of this project was to pilot the integrated water quality management system (IWQMS) that was developed a previous WRC project by introducing the proposed decision support system to an existing institution, to undertake a literature

review on early warning systems and propose how the various options could be incorporated into the IWQMS. The benefits of such a system are: close to real-time water quality/ quantity reporting by the water users; close to real-time access to water quality/ quantity monitoring information; simplified reporting for the regulators; potential to include civil society organisation in the input of water quality data; and the potential for spreading the monitoring footprint and reducing the cost of monitoring to the regulator.

Report no. TT 740/17

Approaches for emerging farmer participation in water resource management: The case of the Breede-Gouritz Catchment Management Agency (BGCMA), Western Cape

After many years of water allocation reform, emerging farmers are still lagging behind as far as equity and access to water resources is concerned, and their participation in water user associations is still limited or passive. The catchment management agencies (CMAs), that have the mandate to provide access to water to these farmers, are faced with various challenges, including water scarcity, drought, climate variability, and challenging institutional arrangements. The extent of these problems varies from CMA to CMA. This project was conceived as a result of discussions with the BGCMA. The research project focused on emerging farmers. The main aim was to assess some of the issues and challenges that have resulted in limited progress in water allocation to historically disadvantaged individuals in the BGCMA, despite all the efforts put into the processes; and to explore ways to alleviate the situation. **Report no. 2310/1/17**

Multi-array sensor technology for polycyclic aromatic hydrocarbons screening in wastewater

Polyaromatic hydrocarbons (PAHs), also called polycyclic aromatic hydrocarbons, have been included in the overarching definition of persistent organic pollutants (POPs). POPs are, typically, organic compounds that are not easy to degrade using conventional methods and which pose a serious threat to the balance of natural ecosystems. The need for low-level detection and quantification of these compounds still presents serious challenges currently, notwithstanding the advances in technology materials and methods that have been made, over the years. The main objectives of the project were the demonstration of a one-pot electro-analytical protocol for onsite, real-time analysis of PAH hydrocarbons in a mixed sample. **Report no. 2454/1/17**



An evidence-based approach to measuring the costs and benefits of changes in aquatic ecosystem services

Human well-being and ecosystems are intimately connected. Human understanding of the value of ecosystems has matured rapidly over the past two decades. The Millennium Ecosystem Assessment's (MEA) concept of ecosystem services introduced a radical new

framework for analysing the value of ecosystems, and this, combined with electronic data collection systems and rapidly increasing computing power has enabled us to improve both our understanding of the value of ecosystems as well as the accuracy of valuations. Yet, despite our improved understanding and our improved valuation techniques, evidence of severe ecological degradation is evident all around us. In this study, the project team focused on aquatic ecosystem services produced by urban river systems. These ecosystem services are especially relevant in South Africa where rapidly increasing urbanisation puts significant pressure on scarce water resources. **Report no. TT 726/17**

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