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Innovation for Development

Department of Science and Technology

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The rays of the sun
Are like a pair of scissors
Cutting the blanket
Of dawn from the sky
Oswald Mtshali

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Contents

Contents:

Foreword

I am pleased to present the second edition of Innovation for Development magazine and we trust that you enjoyed the first edition. In this edition we focus, on among other issues, progress on the Pebble Bed Modular Reactor (PBMR), the successful launch of the African Institute for Mathematical Sciences in Cape Town, profile of CSIR, Tshumisano skills transfer etc.

As you may be aware, this magazine is designed to bridge the gap that exists between government, the scientific community and the public. And as part of the communication mix, we want to use it to develop a greater understanding in the wider South African community of the important role played by science, technology and innovation in all aspects of our life, and particularly in economic and social development.

It is important for the department to communicate, because no major change in the investment of science and technology can be made without public support. Therefore, the public needs to be informed on why and how their taxes are being spent, as political decisions are sensitive to public opinion.

We also want to ensure that there is a good understanding and an ongoing public dialogue on the implication of new knowledge. Many important decisions are based on scientific data. The use of genetically modified organisms in addressing food shortages, the development and testing of drugs for HIV/AIDS, and nuclear energy (PBMR) are examples of issues where science has implications for the development of our society and therefore, a public understanding is important in a democratic debate. The motivation of young people to study and work with science and technology is highly influenced by the way science is presented in the media. However, the media in South Africa is alarmingly disconnected from science and technology as indicated

in a study conducted by Stellenbosch University last year. There are only a handful of scientists who cope well with the media, and there are very few journalists with experience in science writing. There is clearly a lot of catching up to do and a huge need for training on both sides, equipping scientists with media and communication skills, but also training journalists in the intricacies of science and technology reporting.

Although young people may be more sensitive to new ideas, it is also important to increase the general public's interest in science, especially in rural areas where openness to new knowledge-based production forms are needed, as traditional jobs and skills become obsolete because of technical development.

The current situation with regard to recruitment of young people to tertiary education in the natural sciences is far from satisfactory, and future projections lead to the fear that South Africa will face a severe shortage of qualified labour in the key areas of fundamental research and development of new technologies.

We hope that this magazine bridges the gap and contributes to increasing scientific awareness among the wider population. We believe that it is challenging and stimulating and we are inviting those who have not yet become engaged in the issues that modern science raise to join us.
Walala wasala!

Thank you

Nhlanhla Nyide,
General Manager: Science Communication

What is now proved was once only imagined.

William Blake

Pebble Bed Modular Reactor

Technology could solve the electricity capacity

Phumzile Tshelane

A concerted electrification drive since 1994 has resulted in two thirds of South Africans now enjoying the benefits of electricity. In stark contrast, only 10 percent of sub-Saharan Africans have access to electricity. For more than 90 percent of the 650 million people in Africa, energy is about wood, waste, dung, candles and kerosene.

The challenges facing the energy industry in Africa are to find sources that are accessible, reliable, affordable and environmentally friendly…and South Africa may just have the solution in the Pebble Bed Modular Reactor (PBMR) project.

The PBMR is currently being developed by the South African electricity utility Eskom, the Industrial Development Corporation (IDC) and an international partner, British Nuclear Fuels (BNFL), for potential application as a power source in South Africa, as well as a viable South African export product.

The concept is based on experience in the US and particularly Germany where reactors of this type were operated successfully between the late 1960s and 1980s. Although it is not the only high-temperature, gas-cooled nuclear reactor currently being developed in the world (China, for instance, started a research reactor in December 2000), the South African project is regarded internationally as the leader in the power generation field.

The concept almost sounds too good to be true. Its most important and attractive feature is its inherent safety features, which eliminate the possibility of a core meltdown or Chernobyl-type accident. It is also affordable, emits no greenhouse gases, is well suited for desalination purposes and it can be configured to the size required by the communities it serves.

The concept allows for additional modules to be added in accordance with demand. It can operate in isolation anywhere, provided that there is sufficient water for cooling. Dry cooling, although more expensive, is an option that would provide even more freedom of location.

“Technologies such as the PBMR can be instrumental in giving further impetus to the achievement of an African Renaissance and the New Partnership for African Development (Nepad),” says Phumzile Tshelane, Senior Manager: Technology Strategy, PBMR (Pty) Ltd. “It has all the ingredients to play a pivotal role in the economic upliftment of the people of Africa.”

He points out that one of the main challenges of the electrification of Africa is the large distances between settlements, especially in rural areas. “This factor sends reticulation costs rocketing, which means that new electrification options have to be found. The PBMR is a solution, especially since it can operate in isolation anywhere.”

One may therefore ask why does South Africa need a nuclear power

station? Why not just stick to the reliable coal stations?

It is common knowledge that South Africa is too dependent on coal. In fact, more than 90 percent of the country's electricity is coal-fire generated. According to Dr. Steve Lennon, Eskom's Managing Director: Research and Technology, Eskom wants to bring the country's dependence on coal down to 70 percent. "This means that, by 2025, about 18 000 MW of South Africa's capacity will have to be from non-coal generated sources."

Eskom also experiences short, sharp demand peaks in winter that are difficult to accommodate with the slow ramping characteristics of the existing large power stations. These factors prompted Eskom to contemplate small electricity generation plants that can be placed near to the points of demand. The PBMR concept, which has a short construction lead-time, low operating cost and fast load-following characteristics, is such an option.

The PBMR concept is based on the philosophy that new reactors should be small. A commercial PBMR module would be sized to produce about 165 MW, which is about an eighth of the capacity of conventional reactors such as the one at Koeberg near Cape Town. The reactor consists of a vertical steel pressure vessel lined with graphite bricks. It uses silicon carbide coated particles of enriched uranium oxide, encased in graphite to form a fuel sphere or pebble, hence its name. Helium is used as the coolant and energy transfer medium.

The intention is to build a demonstration plant at Koeberg and an associated fuel plant at Pelindaba, where fuel for Koeberg was previously manufactured. If the demonstration plant achieves its targets, it is expected to have a number of worldwide sales opportunities, especially because of its built-in safety characteristics. The Director-General of Enviromental Affairs and Tourism (DEAT) Dr Chippy Olver has issued a positive record decision for the PBMR's mandatory environmental impact assessment (EIA). However, environmental groups have mounted a legal challenge to this decision. The National Nuclear Regulator (NNR) is currently busy with its formal assessment of safety of the PBMR. The positive EIA and the clearance by the NNR are necessary before construction can begin.

However, recently an environmental group called Earthlife Africa launched a High Court application in Cape Town seeking to review the environmental impact assessment granted to Eskom to build a demonstration module PBMR at Koeberg in Cape Town. Earthlife Africa argued that they were not participants in the decision-making process. "Part of our problem is the substantial, critical pieces of information which we did not have access to during the EIA process," stated Earthlife Africa's spokesperson Liz McDaid.

Despite the legal challenges mounted by environmental groups, the PBMR could also provide an economic mitigation strategy for greenhouse gas reductions, *(cont... P. 29)*

DIGITAL DOORWAY PROJECT

The South African Experience

Gerry Le Roux

Acquiring computer skills may be a nightmare to the older generation of this country, but for children, all they need is enough computer access, motivating content and time.

The Digital Doorway Project introduced at Cwili Township in the Eastern Cape last year, seeks to do just that - empower rural young South Africans with functional computer skills. The project, which was established by the Department of Science and Technology (DST) and the Council for Scientific and Industrial Research (CSIR), is aimed at investigating the concept of minimally invasive education (MIE) as a potential mechanism for large-scale computer literacy in support of the advancement of the information society. Dr Sugata Mitra, a cognitive scientist at NIIT in India at the “Hole in the wall “ project, pioneered the MIE concept.

The Digital Doorway Project therefore seeks to verify, in the South African context, results of the research conducted in India, indicating that people, especially children, possess the cognitive ability to acquire functional computer skills without formal training if given enough access, motivating content and time. The first site of the Digital Doorway Project was chosen to be Cwili, a rural township in Kei Mouth, Eastern Cape. Initial interviews at Cwili revealed that among the 2 600 inhabitants, there existed very high levels of illiteracy, no computer literacy, very low levels of computer awareness and very little English knowledge.

After only a few weeks following the installation of the Cwili Digital Doorway multimedia kiosk in November 2002, initial observations by Professor Denzil Russell, a specialist in education from Wits University, revealed that the total number of user visits in the first three months was 8300, although the user group varied between 7 and 56 years of age. The kiosk, which is mainly used for educational games, typing of letters and artwork using the Microsoft Paint programme, surfing the Internet and sending e-mails, was used proportionally by both girls and boys, although the majority of users were school children during the day, with some coming as early as 04:15 in the morning.

The project stands to popularize Information, Communication and Technology (ICT) in the most technologically underdeveloped areas and the formal results of the project may assist in informing government policy and initiatives in the ICT for development arena. It also has the potential as a test-bed for investigating the use of culturally and language sensitive technology and interfaces, and the impact these will have on the speed and uptake of computer literacy.

The success of the Digital Doorway pilot has presented significant opportunities for public-private partnerships in support of sustainable development, and represents a concrete mechanism for closing the gaps between the research community, the public sector and the private sector. The project team is also currently planning a second site in Mamelodi Township, Gauteng.

The success of the Cwili Digital Doorway Project has laid to rest the scepticism shared by many regarding the viability of minimally invasive education for South Africa, and indeed

Africa. The challenge now is to maximize the potential of this concept for the benefit of the continent. In order to rise to that challenge, a much deeper set of questions and issues must be addressed. The next phase of the Digital Doorway Initiative is aimed at unearthing and responding to issues such as the implications of new pedagogic approaches, creating an enabling environment for deriving maximum social and economic benefit from the technology, cost-effectiveness and sustainability. DST and the CSIR remain committed to the Digital Doorway as it represents an important mechanism to complement existing efforts aimed at bringing ICT into the service of development within the context of the New Partnership for Africa's Development (NEPAD).

Digital Doorway Initiative internet link: www.digitaldoorway.co.za.

The Lowdown on Open Source Software

Making money by giving stuff away?

Matthew Chetty

One of the questions often asked about open source, is how a commercial company involved in creating OSS (open source software) can make money, since the software being developed is given away for free. While this is a complex matter, and numerous business models in this regard exist, perhaps the easiest explanation is provided by the example of water. Water, essentially, is free. However, many entities make money with water, such as your local municipality, which makes money by providing access to water in your home. This also includes companies who sell bottled water, who make money by selling water that is branded and has some guarantee of purity. Similarly, software companies can make money by selling services and creating added value around the basic, free open source product.

Over the last few years, OSS has become one of the most extensively debated concepts in the Information, Communication and Technology (ICT) domain. OSS is a term used to describe software of which the source code (the set of commands and operating instructions that define the look and functionality of a piece of software) is made available with the software. This access to the source code effectively allows users and developers to make changes to the code, thereby changing the look and feel and enhancing the functionality of the software. OSS is usually developed in a collaborative manner between developers (often geographically dispersed), and is invariably made available to users at no cost. The value of the open source concept is perhaps best described by the Open Source Initiative:

"The basic idea behind open source is very simple: When programmers can read, redistribute, and modify the source code for a piece of software, the software evolves. People improve it, people adapt it, people fix bugs. And this can happen at a speed that, if one is used to the slow pace of conventional software development, seems astonishing".

Open source software provides users and developers with freedom. The "free" used here refers not only to the software being free of cost – more importantly, it refers to the fact that OSS provides freedom to use the software as you want, when required to.

A document prepared in January 2002 by the National Advisory Council on Innovation (NACI) entitled "Open Software and Open Standards in South Africa – A critical digital divide", has sparked the debate around open source in South Africa, and continues to shape thinking on the subject. This document expounds a practical vision of the benefits of OSS, specifically addressing South African scenarios.

The concept of open source software is particularly relevant in the South African context, since developers are free to change the software, by changing the language interface, thereby enabling users to use the software in their chosen language. Access to the source code enables developers to study the code, and to learn from the practical example of software developed by international experts. As such, OSS can be a great training tool. Developers of software don't need to do all their development from scratch, but rather they can build on existing open platforms, and use open software libraries and functions as the basis for building new software, thereby significantly reducing the software development effort and time.

Scaled-down versions of OSS products, that do not require very powerful hardware to function properly, can be used effectively in schools and communities who do not have the funds to buy the latest hardware and software. This works particularly well in situations where second-hand refurbished PCs, that are not powerful enough to run the latest proprietary software, have been donated to schools and communities. Since OSS is free of cost, it means less money leaving the country to international software companies for software purchases, and annual software licensing fees. This means that more money can become available to the local ICT industry, e.g. to train developers to maintain and enhance open source software.

Because of the wide-ranging benefits that can potentially be derived from the increased adoption of OSS in South Africa, OSS has come to be considered an issue of national importance. As a result, a number of forums have been created, both in the public and private sector, to coordinate OSS activities.

At the government level, the Government IT Officers Council (GITOC) has established an open source workgroup, specifically tasked with the development of a national policy framework for OSS in the SA government. The policy developed by the GITOC OSS Workgroup, and recently approved by Cabinet, attempts to "level the ICT playing field", to allow OSS with a better chance of competing with better-known proprietary software products. Since government is the largest user and procurer of software in the country, it is believed that increased adoption of OSS in government will have a ripple effect across the ICT industry, and significantly increase the awareness and use of OSS in other sectors.

Beyond government, a number of South African initiatives have come into existence to coordinate and align OSS activities towards a common goal. Some of the most prominent examples include:

- The Meraka Open Source Centre at the CSIR, which will be involved in OSS advocacy and training, and in coordinating OSS development projects. Meraka will receive funding from DST;
- The AVOIR initiative started by the University of the Western Cape (UWC), which aims to contribute to the establishment

International OSS trends

- Internationally, many governments are seriously considering the use of OSS in the public sector, developing policies and legislation in this regard. Examples include the UK, Germany, Brazil and Australia. Where South Africa used to look towards examples in other countries in its OSS policy for development process, the situation is starting to reverse, with many countries beginning to use the progressive OSS policy framework developed by the South African government as a reference in the development of their policies.

- Large multinational ICT companies are increasingly throwing their weight behind OSS. Prime examples include IBM, HP, Sun and Oracle.

- Large software vendors are increasingly realising that even their proprietary software needs to be at least compatible with open source and open standards, in order to survive the challenge posed by this new software paradigm.

of a vibrant OSS development community in South Africa.

- The public-private open source coalition proposed by the Shuttleworth Foundation, which will focus on extensive awareness creation at all levels of society, and align large scale OSS activities across the public and private sectors.
- The Linux User Groups (LUGs) that operate across the country, and serve as a forum for open source developers to interact on technical matters.

It is critical that these initiatives operate in harmony rather than working against each other, and therefore the ICT Technology Mission Unit in DST is interacting with many role players, to establish common goals to optimise the value to be gained from OSS in South Africa.

From the Science and Technology point of view, one of the main benefits of OSS lies in its ability to stimulate research and development in the ICT environment, and its potential to foster local ICT innovation. As such, the Department is committed to promoting OSS in pre-competitive research and development projects financed with public funds, and promoting the establishment of OSS development capacity at tertiary education institutions. A number of issues related to the increased use and adoption also requires further research, which the Department will actively promote. This includes understanding the challenges involved in large-scale OSS adoption, and determining what would be the best open source licensing to be used in the South African context, particularly in government OSS projects.

In closing, a final word from the Open Source Initiative:

> *"Open source software is an idea whose time has finally come. For twenty years it has been building momentum in the technical cultures that built the Internet and the World Wide Web. Now it's breaking out into the commercial world, and that's changing all the rules. Are you ready?"*

Success stories

Numerous examples exist, both locally and internationally, where OSS has been instrumental in the success of IT systems.

The Internet is probably the best known example – much of the Internet was developed using OSS, and the open standards upon which the development of the Internet is based, has been crucial to the massive growth of the Internet.

Closer to home, the Mark Shuttleworth success story also has strong OSS links. Mark Shuttleworth used open source extensively in the development of the software for his company, Thawte Consulting, and he has been quoted as saying that he would not have been able to do what he did without OSS.

Some useful websites

- The National Advisory Council on Innovation (contains their OSS discussion document): http://www.naci.org.za
- The OSS website of the South African government: http://www.oss.gov.za
- The Free and Open Source Software Foundation for Africa: http://www.fossfa.org/
- The CSIR Meraka Open Source Centre: http://www.meraka.org.za
- The UWC AVOIR initiative: http://www.avoir.uwc.ac.za
- The Open Source Initiative: http://www.opensource.org/
- The Free Software Foundation: http://www.gnu.org/
- The Shuttleworth Open Source Community Portal: http://www.tsf.org.za/oscp/

Open source licences

Various licenses exist that specify how open source software can be used.

- The most fundamental open source licence is the GNU General Public License (GPL). When a user creates any software that contains GPL code, or makes changes to GPL code, this new software has to be made public as GPL code as well. This license was designed to aggressively encourage sharing and re-use of code.
- A slightly less strict licence, known as the Lesser General Public License (LGPL) allows users to use LGPL software modules/libraries in their software without having to open source their software, as long as the LGPL libraries are not modified. Only when users make changes or additions to the LGPL code itself, are they forced to make the modifications public.
- The Berkeley Software Distribution (BSD) license does not force you to release the source files that have been modified – essentially all it enforces is that you keep the copyright notice at the top of the source file that has been modified. This license was designed to track authorship and disclaim liability for damages. Many open source development tools are released under a BSD-type license.

Nanotechnology *Dr Bethuel Sehlapelo*

Nanotechnology, referred to as the technology of the small, is essentially about everything made of atoms, be it a stone, a pen, a video game, a TV, a dog or a human as all are formed by atoms. Atoms build molecules or form materials. Nanotechnology deals with the production, measurement and processing of small structures and components of dimensions 0.1 to 100 nanometres*. The resultant materials, devices, systems and even machines often exhibit novel and significantly changed physical, chemical, and biological properties. Ever since the first human beings started to "make things", we have started *from "big things"* (wood, stones, mineral ores) to obtain or extract what we want. Now we want to start *from "small things"* (atoms and molecules), to assemble and obtain what we want.

Nanotechnology can hold benefits for South Africa in the following areas: affordable and alternative energy provision for rural communities, affordable water, health, and advanced materials for construction, mining, and textile industries. However, more research is required before these benefits can be realised. Most countries invest large amounts of money on Nanotechnology R&D for example:

Japan	~ $ 650m
W. Europe	~ $ 400m
USA	~ $ 710m
Other	~ $ 500m

Locally, the investment is relatively limited compared to the figures given above. It is also not known exactly where Nanotechnology will play a role in South Africa and the world, but what is certain is that its impact will be tremendous. South African niches in global markets may include serving the needs of Africa and other developing nations with knowledge based solutions in education and skills transfer, water treatment, low cost energy, low cost electronics, drug delivery, security and monitoring, chemicals and plastics processing, new materials value addition to resources, nanomaterials sourced from our biodiversity, standardization and metrology. Niche markets can also be achieved by focusing on environmental applications of Nanotechnology, taking into account environmental guidelines such as the Kyoto protocol.

First generation Nanotechnology products are already generating wealth in South Africa by improving existing processes. For instance, South Africa has already shown that it is possible to use Nanotechnology to advantage in the field of catalysis. Here particularly, knowledge of manipulation at the nanoscale is well understood and extensively used in the chemical processing industry. Other areas where Nanotechnology products are already on the market or near the market, where South Africa may already have a significant competitive edge is in water and effluent treatment technology, in ultra hard nanomaterials for wear resistance in mining applications and in protective coatings and paints which already incorporate nanoparticles to enhance performance.

Internationally, display technologies, cosmetics and nanocomposite plastics are areas where Nanotechnology holds promise for consumer products within the next three years. In health, it is envisaged that drug delivery and bioanalysis will lead the way in the application of Nanotechnology, followed by biopharmaceuticals, prosthetics, biomimetic systems and cheaper, more portable nano-analysis tools using nanofluidics. South African activities in Nanotechnology are summarised below, including examples of Medical applications of Nanotechnology.

Starting from "small things" means absolute precision (down to one single atom!), complete control of processes (no waste?) and the use of less energy (with less CO2, less greenhouse effect, etc…). The fact that we deal with small particles means that safety precautions need to be taken to prevent potential adverse health effects. The fears of

** 1 nanometre = 1millionth of a millimetre*

perceived (even if sometimes unrealistic) risks should be taken into account, and the highlighted justification outlined, in addition to concern for South African citizens, in carrying out such research. We cannot afford, as happened too many times in the past, to produce, deliver goods and services, create wealth and provide employment which pollute and therefore cause environmental disasters and problems to people's health.

We have to do things together, to do simultaneous engineering by expanding knowledge of possible new technologies and associated risks - if there are any. A linear approach is no longer successful, even in industry. We cannot first study nano-powders and then see whether they are dangerous and take counter measures to repair disasters that have already happened. We cannot, however, stop studying before we know in depth the basic principles, and which materials, products or services we can create. We have to carry out parallel studies simultaneously to be responsible.

Every project selected for funding should contain, where appropriate, safety, ethical, measuring standards and educational aspects. Knowledge (and research) dispense with unjustified fears. Moreover, we have to distinguish between science, its possible applications and its impact on life.

On the other hand Nanotechnology and Biotechnology are two different types of cutting-edge technology that are promising and/or threatening, that can radically change human abilities and capacities and even our identities. Government needs to invest in nanotechnology R&D in order to make science based policy decisions regarding nanotechnology and its safe application. Our scope is to help people, to serve people, to improve the quality of life for people, to improve industrial competitiveness, to protect or improve the environment and to support European policies.

Nanotechnology is based on the ability to create and utilize material, devices and systems through manipulation of matter at the nanometre scale. Broad scientific breakthroughs and new technological developments are leading to rapid commercialization. For example, the efficiency of energy conversion can be increased through the use of new nanostructured materials with enhanced magnetic, light emission or wear resistant properties. Energy generation using nanostructured "solar cells" or catalysts based on nanoclustered materials could fundamentally change the economic viability of renewable energy sources. In addition, the ability to imitate molecular processes found in living organisms may be key to developing highly sensitive and discriminating chemical and biological sensors. Such sensors will greatly expand the range of medical home testing as well as provide new technologies to counter the spread of chemical and biological weapons. Even the production of chemicals and materials could be revolutionized through the development of molecular reactors that can promote low energy chemical pathways for materials synthesis. And finally, when conventional silicon based microprocessors cannot be shrunk further or made faster due to fundamental physical limits, quantum computing based on carbon nanotubes may lead to the development of "supercomputers on a chip."

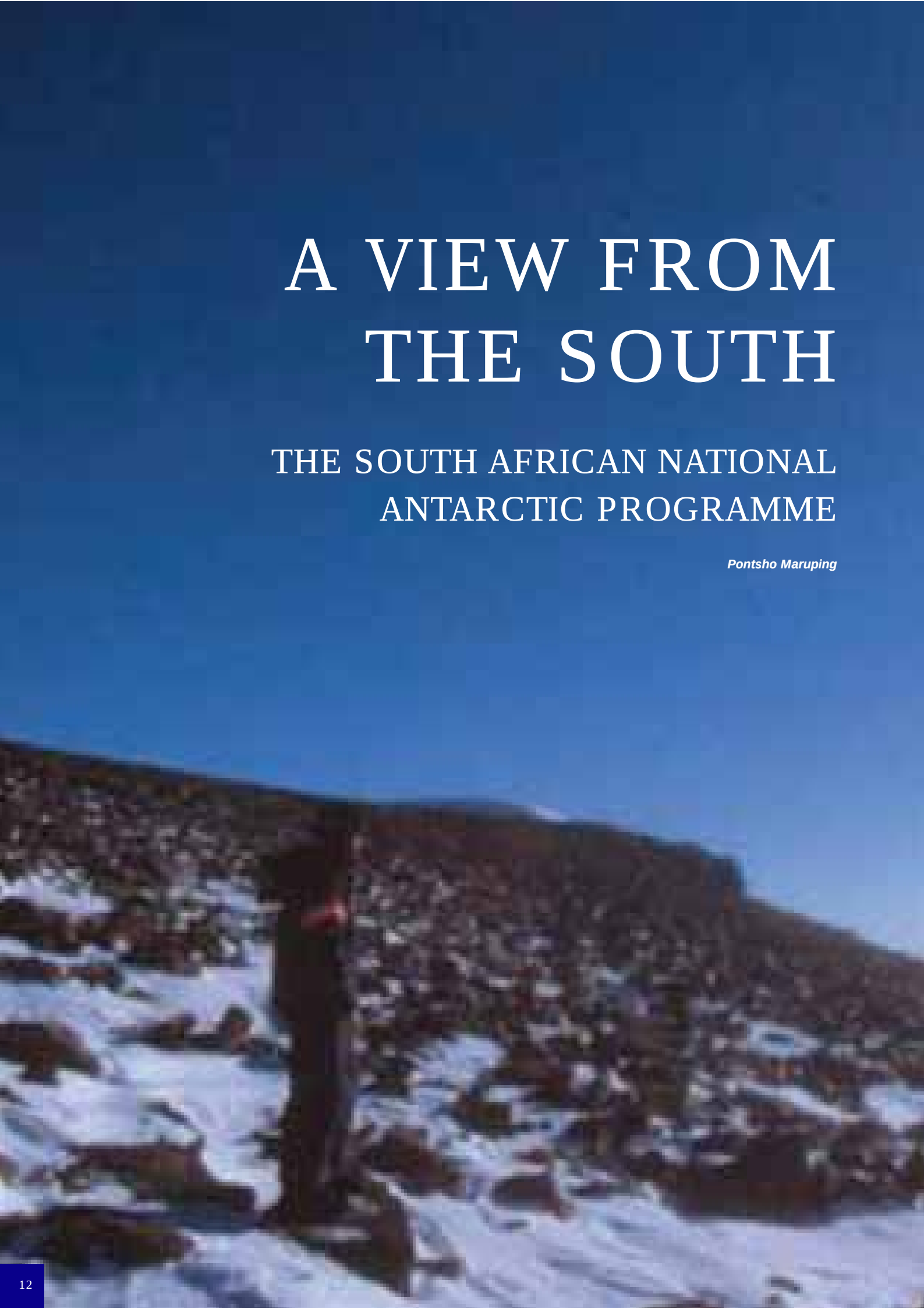
Nanotechnology is a tool, an approach. The interesting thing is that nanotechnology seems to be a very powerful approach to achieving these goals. Government recognises the future opportunities that nanotechnology may present to South Africa and hence a nanotechnology strategy is in the process of being developed in order to take full advantage of these in future.

Most of the activities in Nanotechnology are still very much in the R&D stage with potential benefits expected in the long-term hence South Africa has not yet been left behind. Although nanotechnologies hold great promise, significant scientific challenges must be addressed before that promise can be converted into a reality. A key challenge in nanoscience is to understand how nano-scale tailoring of materials can lead to novel and enhanced functions.

A VIEW FROM THE SOUTH

THE SOUTH AFRICAN NATIONAL ANTARCTIC PROGRAMME

Pontsho Maruping



Knowing what temperatures can be expected daily, or whether it will snow or rain tomorrow is often taken for granted, but what happens to our weather is core to the South African National Antarctic Programme (SANAP) in the Prince Edward Islands. The programme monitors climate changes in the country and in the world, with early warning systems in place.

After the Second World War, General Smuts, in consultation with the British government, set in motion the acquisition of the Prince Edward Islands. The Prince Edward Islands are sovereign South African territory and South Africa has operated a research station there since 1947. South Africa operates a weather station on Gough Island under an agreement with the United Kingdom under which South Africa, for more than 50 years, has maintained a permanent presence on Marion Island.

Gough Island is a volcanic island in the central South Atlantic Ocean, about 2700 km south southwest from Cape Town and over 3200 km from the nearest point of South America. The weather in Gough Island varies greatly with the change of seasons, and the summers are relatively dry, with temperatures occasionally rising above 15ºC. Initially discovered by Goncalo Alvarez, and known as Diego Alvarez in the 16th Century, it was later called Gough Island by sealers and whalers. Its rainfall is erratic, with dry spells of up to seven or eight days, separated by days with rainfall of 30 to 40 mm, reaching as much as 100 mm in 24 hours. In contrast, winters are characterized by continuous rainfall, with some days only a few mm and others averaging 15-20 mm.

The Gough Island weather station is considered to be one of the most important stations in the world. It is one of a few weather stations in the Southern Atlantic Ocean. It helps to provide information of weather systems of the oceans surrounding South Africa - areas from where very little information is available. In terms of the needs of the World Meteorological Organisation, the South African weather service manages two fully manned island weather stations; Gough and Marion Islands. South Africa has automatic weather stations on Tristan da Cunha, SANAE (Antarctica), Southern Thule and Zavadovski Islands, and 30-40 drifting weather buoys are deployed annually.

However, Marion Island, the larger of the Prince Edward Islands group is situated in the 'roaring forties' and lies approximately 1770 km south east of Port Elizabeth. Marion Island, which politically forms part of South Africa's Cape of Good Hope Province is about 290 square kilometres in area with 72 km of mostly cliff-face coastline. This never warm island lies approximately 200 km north of the Antarctic Convergence in the middle of three water masses, where cold Antarctic waters sink below the slightly warmer sub-Antarctic waters. The mean monthly air temperature of the island closely tracks that of the ocean, which ranges from 3.6°C in August to 7.9°C in February. Sunshine duration averages 3.6 hours a day and the climate could be summarized like all other sub-Antarctic islands as cold, wet and windy.

In 1959, The Antarctic treaty, which provides a system of governance for Antarctica was signed. South Africa is one of the twelve original signatories and hence has voting status. The treaty currently has 47 members and aims to keep the region free of international discord and ensures that national interest is served through meaningful international scientific collaboration.

Over the years, the reasons for a national presence have evolved but scientific discovery remains at the forefront. What scientists have learned about the Antarctic is that it is an integral part of Planet Earth, generating much of South Africa’s weather, powering currents in the oceans and is a key to our understanding of major global phenomenological problems.

The South African Antarctic research is divided into five main disciplines covering biological sciences, earth sciences, oceanographic science (the southern ocean), physical sciences and engineering as the most recent addition.

Geological, geomorphological and paleoecological work has established a history of the islands and provided their genesis and geological setting. The biological work has investigated topics such as the basic aspects of species breeding, population trends, energetic physiology, feeding and prey selection, behaviour, life history strategies and more recently, the significant impact of long-line Patagonian tooth fishery.

As part of South Africa’s fulfilment of its obligation to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Marine and Coastal Management (MCM) Division of the Department of Environmental Affairs and Tourism undertakes extensive research on the resource potential of Antarctic krill (Euphuasia superba) in the Southern Ocean. Krill is a tiny, shrimp-like crustacean that eats microscopic marine plants called phytoplankton and forms the base of the marine food chain. Models of krill spatial distribution developed from the large database created are used in finding new approaches to manage the krill fishery.

Perhaps the most important outcome of the scientific research is an integrated view of ecosystem functioning. Earlier fundamental ecological work has allowed the integrated

investigation of two globally important research fields, and that is the nature and influence of biological invasions, the effect of climate change on both the indigenous species and their interactions with invasive species.

Antarctica is a unique international laboratory for science and hence creates a unique opportunity for human resource development. Since 1996, SANAP has trained at least 20 Masters and 12 Doctoral students. There has been renewed effort in increasing the number of previously disadvantaged students in the program during the past four years and this will continue. Future efforts should not only focus on making funding available for Historically Disadvantaged Institutions (HDIs) but also developing a strong mentorship programme coupled with wider publication of knowledge concerning Antarctica.

Because of the nature of the work, international scientific collaboration occurs at various levels. An example includes projects such as the Southern Hemisphere Auroral Radar Experiment (SHARE), which is a collaboration between South Africa, the United Kingdom and the United States of America and the Seismology Project with Germany.

Escalating costs and decreasing budgets are posing a threat to the scientific work in Antarctica. The level of research funding has remained sub-critical at an amount of R3.5m but has subsequently been increased to R5m with the recent transfer to DST. Perhaps one should ask whether, given the more pressing societal needs that South Africa is facing, should the government continue to fund this research at all.

But, the long-term view suggests that it remains vital for our country to continue research in Antarctic. Climate change and species invasions are here to stay. The Antarctic may be geographically remote, but it has great relevance to current environmental issues. Studies in the Antarctic contribute to the worldwide effort to understand how our planet works as an integrated whole, and to predict how it will behave in the future. With the Earth placed under ever, greater stress as the human population and economic activities continue to grow, the research challenge is increasingly a race against time. Scientific understanding offers the only means of achieving "Sustainable Development", but the pace of change is such that policy makers need sound advice based on Earth System Science, sooner rather than later.






The CSIR uses science and technology to improve the well-being of South Africans

Josias Maraba

When someone mentions CSIR (Council for Scientific and Industrial Research), one conjures an image of white-coated test-tube wielding nutty professors hidden away in their ivory tower with hardly any concern for the issues that affect the rest of the society. Nowadays, however, CSIR uses science and technology to improve the well being of South Africans, particularly by way of using science and technology to alleviate poverty, seeking to combat the scourge of HIV/Aids, using new knowledge and innovative structure to prevent crime, developing partnerships in rural areas to enhance development and supporting manufacturing industry.

CSIR, a South African statutory research council, was established in Parliament in 1945, by developer and expert in radar application Dr Basil Schonland, upon request from Prime Minister Jan Smuts, who was a keen amateur scientist. CSIR was mainly focused in defence then, but its role changed on 6 February 1978, when the Minister of Defence announced that the development and manufacture of missiles was to be transferred from the CSIR to a wholly owned affiliate company of ARMSCOR, Brimstone Projects, since the increased manufacturing activities were contrary to the statutory mandate of the CSIR.

After 1961, when South Africa became a Republic and the struggle for democratic rule entered the military phase, key drivers of research and development were, increasingly: military dominance in the sub-continent, energy self-sufficiency and national food security. This gave rise to greater focus on the oil from coal programme at Sasol and associated petrochemical spin-offs, a comprehensive and increasingly domestic (following sanctions) arms acquisition programme directed by Armscor but involving the entire national research system, and the uranium separation programme located at the Atomic Energy Corporation; and a solid national infrastructure in the agricultural sciences.

By 1994 the large expenditures on nuclear and military research had ebbed considerably and previously key programmes were in tatters. Overnight the new research drivers became economic competitiveness within a global environment - sanctions had been removed and quality of life improved; South Africans could vote. A key challenge for the new democratic government was to preserve morale among scientists (prevent brain drain) while turning the system around to serve these new priorities. Today CSIR is not only the largest research and development (R&D) organisation in Africa, accounting

for about 10% of public industrial R&D spending on the African continent, but remains the top technology and innovation agency in the country. The institution delivers specialist scientific and technological services and support to some 7 000 clients in industry, to parastatals and government. CSIR develops new technologies for clients, which can be refined and commercialised by the private sector.

The CSIR has eight major operating business units, active in technology areas ranging from aeronautics; biological, chemical and food processing; information and communications. Other business units include manufacturing, materials, mining, textiles, construction, roads, transport and the environment. Building measurable value through the creation of local and international alliances and partnerships with other science and technology organisations, industry and academic institutions remain a key component in their endeavors to provide world-class technology. CSIR receives an annual grant of close to 35% of its total income from Parliament.

According to CSIR's Chief Executive Officer, Dr Sibusiso Sibisi, the CSIR together with the DST, have implemented a number of poverty alleviation projects such as the development of community-based essential oils businesses in the Western Cape, Limpopo and Mpumalanga. "There are various projects throughout South Africa, such as the promoting and commercialising of indigenous foods through the provision of technology solutions; infrastructure development, working with the mining industry to combat HIV/AIDS, and making clean water accessible to rural communities. These poverty alleviation projects are not only about sustenance, but also about empowering young South Africans through centres for community development in schools and protecting children using a 'Volunteer Child Network' to assist in combating child abuse," he said.

A centre/school for community development, that aims to address the need for high quality school education and community development in poverty-stricken rural areas of South Africa was initiated by the National Department of Education. The programme introduces a new approach to the design, construction and operation of school buildings in South Africa and investigates how they can be developed to support cost-effective, high quality school education as well as community development through training, employment creation and enabling access to gardens, workshops and learning resource centres. Entitled Thuba Makote ("breaking soil clods to prepare for planting'), the project is managed by the CSIR, working closely with local consultants. Similar pilot projects have been initiated in each of South Africa's nine provinces.




As a key knowledge institution in Africa, CSIR is providing S&T leadership and support to NEPAD, interacting on a continental basis with relevant players. CSIR also contributes to NEPAD's market access and diversification leg by providing inputs on metrology, manufacturing, industrialisation and SMMEs. With Africa's recovery heavily resting on value addition and the beneficiation of Africa's natural resources, the CSIR is assisting companies to develop products and services for export, and contributing to the development of the infrastructural base required to make export activities a reality.

The CSIR is interacting with key players responsible for the leadership and management of the NEPAD ICT process through the e-Africa commission based at the CSIR. Competencies are also being utilised to contribute to NEPAD's peace, security and reconstruction processes. NEPAD recognises that the existing large structural gap in infrastructure constitutes a serious handicap to economic growth, trade, competitiveness and poverty reduction. The CSIR responded to this challenge by aligning resources within its infrastructure core competence to form the CSIR Infrastructure Thrust.

The highest wisdom has but one science - the science explaining the whole creation and man's place in it.

Leo Tolstoy

Apart from these specific activities, a number of CSIR projects indirectly support the aims of NEPAD, such as the alleviation of Vitamin A deficiency in Africa; supporting sustainable construction in developing countries; the Mozambique soya education programme; the water banking strategy and road safety strategy for World Bank programmes. The CSIR is the first institution worldwide to gain permission to transfer the 'golden rice' technology to maize and sorghum under a sub-licence with Syngenta. This agreement represents a major breakthrough in terms of the responsible introduction of the technology for the alleviation of vitamin A deficiency in Africa. The Department of Health recently reported that 33.3 % of preschool children in South Africa suffer from vitamin A deficiency, which can result in childhood blindness (xerophthalmia) and death. Another technology introduced by the CSIR in Windhoek, Namibia, was a strategy for water banking, which aims to artificially recharge the Windhoek aquifer. Recharging will replenish the groundwater that has been removed from storage through periods of excessive pumping. The overall objective is however to ensure a dependable groundwater resource by ensuring that the city's "water bank" is full when water is available for artificial recharge.

CSIR's activities vary internationally, from Global Research Alliance to exporting locally developed simulator technology and the international space industry. A significant event in the context of globalisation of R&D was the establishment of the Global Research Alliance (GRA) in January 2003, with the objective of applying a global knowledge pool for global good through global funding. The Alliance will facilitate international R&D cooperation to address the problems facing the world, especially in the areas of water, health, energy, transportation and the digital divide.

The CSIR is not only concerned about bridging the digital divide, but has also recently exported the Enigma ll Electronic Countermeasure and Radar Target Simulator. This represents a major milestone in the development of Digital Radio Frequency Memory-based simulator technology, developed in close collaboration with EW Simulation Technologies. The Enigma system can be used to evaluate operational radar robustness against electronic attacks, in acceptance testing of new radar and to test tracking filters and electronic protection functionality during radar technology development. The CSIR Satellite Applications Centre also continues to strengthen its reputation in the international space industry as a reliable provider of satellite ground segment services. Through the completion of a new Ka-band antenna for the tracking, commanding and monitoring of a new constellation of satellites - dubbed Spaceway - under contract to The Boeing Company, CSIR was put at the cutting edge of satellite tracking worldwide. Ka-band refers to very high frequencies that have not, until now, been used for operational satellite tracking. The antenna system will be used operationally for the first time when the first of this next-generation communication satellite system, owned by Hughes Network Systems, is launched later this year.

The latest CSIR highlight was the launching of the Advance Manufacturing Technology Strategy (AMTS) by Minister for Arts, Culture, Science and Technology, Dr Ben Ngubane on September 29, 2003. The strategy is set to boost future competitiveness of the local manufacturing sector. During his address, Dr Ngubane emphasised that South Africa's "future competitiveness will depend on the capacity of the manufacturing sector to master information technology, to innovate and to meet the precise needs of customers".

The South African Natural Scientific Professions Bill
Why is it necessary?

Dr Anusha Lucen

The new Bill provides for the establishment of the South African Council for Natural Scientific Professions. It also provides for the registration of professional, candidate and certificated natural scientists and other related matters. DST's programme, Government Science and Technology System has been intimately involved in placing a transformed Natural Scientific Professions Act on the South African statute book. The Bill became necessary to review the Natural Scientific Professions Act assented to in 1993 due to its limitations, particularly in view of the dramatic changes that have taken place in both the science and education arena since 1994.

However, the limitations are being addressed in the new Bill. Stipulations regarding appointment procedures of Council members in this Bill are made more transparent and flexible, creating the opportunity for Council members to be nominated through an open process of public participation. Furthermore, in the interests of good governance, the Bill requires that nominations be presented to an advisory panel ensuring that the appointment of Council members is handled in an open and inclusive manner, resulting in a Council broadly representative of the demographics of the country.

There have been developments in the tertiary education system since 1993, for example the establishment of the South African Qualifications Authority. The Bill takes cognizance of these developments in education and such changes are reflected in the description of the Council's functions. In particular, the Council will consult with the South African Qualifications Authority to determine competency standards for the purposes of registration, as well as consult with the Council for Higher Education regarding matters relevant to education in the natural sciences. The Bill also includes certain stipulations needed to ensure more efficient management of the Council. In this regard, it calls for regular financial and management reporting in accordance with the recent legislative and regulatory prescriptions.

Since scientific professions represent a critical element of the workforce within a knowledge economy, it is crucial to provide an effective process of monitoring and registering certain categories of practitioners, so that their economic activities can be undertaken in a fully professional manner. There is a fundamental need to provide scientists with an opportunity to be registered and, therefore to be available to the South African community to assist in, for instance, the setting of standards for the quality of training that is provided within the public education system.

Furthermore, science and technology is critical to the future of South Africa. Government recognizes the key role it plays in providing an enabling environment for innovation and research, and in building the human capital that we require for the knowledge economy. Innovation needs well-trained, effective scientists, engineers and technologists. There is increasing evidence that our progress in producing scientists, engineers and technologists is not satisfactory. We therefore need a number of interventions to strengthen the transformation of our science and technology capacity to achieve increased numbers of people working in key fields that are of importance to the future.

This new Bill provides positive steps forward in addressing the challenges outlined. It allows for the Council to establish and administer a fund for the purposes of education and training of students in the natural scientific professions and for the continued education and training of registered persons in compliance with the national developmental imperatives. The Bill is currently with the Presidency for ratification to become an Act.

TOWARDS A MORE RIGOROUS SYSTEM OF PERFORMANCE MANAGEMENT FOR SCIENCE, ENGINEERING AND TECHNOLOGY INSTITUTIONS (SETIs)

Dr Anusha Lucen

The former Department of Arts, Culture, Science and Technology (now split into the respective Departments of Arts & Culture (DAC) and Science & Technology (DST)) commissioned a System-Wide Review in 1997 to investigate the governance and management structures of Science, Education and Technology Institutes (SETIs). One of the principal recommendations of the System-Wide Review was that key performance indicators (KPIs) should be established throughout the publicly funded research system and that these should become an integral part of the management and monitoring processes within each SETI, as well as at line department level. The key performance indicators (KPIs) would have to be set, checked for relevance regularly, and the process of measurement would have to be continuous. Wherever possible, the KPIs would be benchmarked against global players in the same fields. The System-Wide Review also presented a list of potential general and specific KPIs for use within SETIs.

Against this background, the Department commissioned a project to develop a set of KPIs for the Science Councils during 1998. This project sought to refine the general KPIs recommended in the system-wide review, and to develop additional KPIs at lower levels of the system. These KPIs would serve as benchmarks against which progress would be assessed. The project took into account the accountability framework provided by the existing Financing and Reporting System that was developed for Science Councils, and was informed by the National Research and Technology Audit, as well as the National Research and Technology Foresight. The KPI framework was developed on the basis of the Balanced Scorecard approach to performance management. Initially, four perspectives were considered, namely the financial and investment perspective, the stakeholder perspective/customer perspective, the organisational perspective and the innovation and learning perspective. The four perspectives were later supplemented to include a fifth perspective, namely the human resources and transformation perspective.

Each Science Council adapted this KPI framework to its own unique situation and provided these KPI frameworks to the Department. Subsequently, Science Councils have reported in terms of their KPI frameworks to the Department for 2000/2001, 2001/2002 and 2002/2003.

In its quest to improve on the performance management and reporting within the science system, the Department of Science and Technology recently commissioned a study to review the Science Councils' KPI reports and Annual reports for 2001/2002. The fundamental aim of this review was to assess the robustness of the Department's KPI framework and Annual Reports in evaluating the performance of Science Councils in the context of the broader priorities set in respect of the National System of Innovation. The review focused on the first two years of comprehensive Balanced Scorecard reporting, as well as considered the Balanced Scorecard as a framework for managing and monitoring performance, hence eleven science councils were reviewed.

Although each of the Council's KPI reports and Annual Reports were studied and reported on, four Councils were singled out as case studies namely the CSIR, the Medical Research Council (MRC), Mintek and the HSRC since each of these have adopted a different approach to the Balanced Scorecard. The information gleaned from these case studies was used to evaluate the five perspectives that form the basis of the KPI framework mentioned earlier.

The review report recommends, among other perspectives, that the five perspectives be maintained, but that the stakeholder perspective enjoy pre-eminence. Changes were also suggested to the reporting of equity profiles to facilitate a uniform picture across the system. The Councils should be allowed the freedom to combine the KPI and the annual report, and avoid duplication in the process.

The DST continues to develop and refine the existing system of performance management for Science Councils with the aim of improving institutional effectiveness and efficiency. In addition to KPI reporting, periodic reviews of science councils have also been instituted following the recommendations of the System-Wide Review of 1997 and are generally aimed at assessing the internal systems and external relationships of the science councils with the broader stakeholder community. Thus far, the Medical Research Council (MRC) and the Council for Geosciences (CGS) have completed their first periodic institutional reviews. The Human Sciences Research Council (HSRC) is currently conducting its institutional review and a report on the findings should be available by the end of 2003.

It is encouraging to note that there is improved compliance of science councils with performance reporting thereby facilitating better alignment with national priorities. Having achieved these milestones, the challenge remains to design a comprehensive system for the management of SETIs that will establish coherence and synergy in government research in order to compete successfully within the dynamic world economy.

The Hartebeesthoek Radio Astronomy Observatory

S.A.'s only radio telescope

Dr Mike Gaylard

Being the only radio telescope in Africa, the Hartebeesthoek Radio Astronomy Observatory (HartRAO) has come a long way from its origins as a stripped, decommissioned tracking station for NASA spacecraft.

The continuous process of upgrading HartRAO has brought it close to state of the art and is fully compatible with current overseas technology. Initially rebuilt purely as a radio astronomy research facility, HartRAO remains competitive and has grown major new 'arms', that is space geodesy, science and technology, education and outreach.

The telescope can operate on its own as an independent instrument, observing phenomena such as star birth and star death, masers and quasars. In March 2003, for example, the first detection of periodic variations in methanol masers in star-forming regions were published, the result of a multi-year monitoring campaign at HartRAO. This behaviour, which is regular as a clock ticking, is most likely due to the presence of a star, or possibly even a planet in a close orbit around the massive protostar that excites the maser.

In addition, the telescope operates as part of the global network of radio telescopes. These form 10 000 km diameter "virtual" radio telescopes, able to see details on an angular scale of a millionth of a degree in objects across the universe. This networking technique is called "Very Long Baseline Interferometry" (VLBI). It is able to map precisely the radio emission from objects such as the maser spots in the dense clouds swirling around protostars in the Milky Way, and the structure in jets emerging from around black holes in quasars millions of light years away.

As the only telescope in Africa, HartRAO is uniquely placed to add value to the world's VLBI networks. For example, HartRAO last year became part of the European VLBI Network (EVN). It also operates with the Australia Telescope Long Baseline Array (AT-LBA), the Asia Pacific Telescope (APT), US Very Long Baseline Array (VLBA), and the orbiting Japanese radio telescope (Halca / VSOP). The map of networks of radio telescopes used for astronomical VLBI shows the importance of the location of Hartebeesthoek.

A spin-off of this technique is that the positions of the telescopes in the network are determined very accurately as part of the data reduction process. This fact has been capitalised on to measure the varying positions of the telescopes on timescales of hours to decades. This provides absolute measurements of, for example, tides in the solid Earth, the varying rate at which the Earth rotates, and the movement of the tectonic plates - colloquially known as "continental drift". The participation of Hartebeesthoek in these "geodetic VLBI" experiments provided the first real-time determination of the motion of the African tectonic plate - 25 mm per year in a north easterly direction, and with an uncertainty, after two decades of measurement, of less than 0.2 mm per year. The development of the geodectic VLBI capability formed the basis for the Space Geodesy Programme at Hartebeesthoek. HartRAO is part of the International VLBI Service for Geodesy and Astrometry.

Another spin-off has been the placing of a Satellite Laser Ranger (SLR) at Hartebeesthoek in a joint project with NASA. The SLR fires laser light pulses at satellites and uses the light travel time to measure their orbits to an accuracy of centimetres. Satellites tracked in this way include positioning and navigation system satellites (Global Positioning System - GPS - and Glonass), satellites used to measure the changing height of the sea surface in the face of global warming, and to measure the gravity field of the Earth. HartRAO is part of the International Laser Ranging Service.

HartRAO also plays a key role in the South African bid for the Square Kilometre Array, intended to be the ultimate telescope. The SKA will not only be the largest invention of a radio telescope but is set to last for fifty years. The development of the SKA explicitly depends on technology yet to be invented, opening up many possibilities for South African tertiary education institutions and industry and is geared for total involvement should the South African bid for the SKA be successful.
Internet link - http://www.hartrao.ac.za

Ex Africa semper aliquid novi.
Out of Africa always something new.
Pliny, the Elder



THE AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES LAUNCH
Mathematics network of excellence

Nhlanhla Nyide

The African Institute for Mathematical Sciences (AIMS), a new state of the art educational centre, was formally launched on Thursday, 18 September 2003, in Muizenberg, Cape Town in an event that was attended by the who's who in the mathematical and scientific arenas.

The Department of Science and Technology (DST) has spent over R1 million to support the AIMS programme linked to Centres and Networks of Excellence in science and technology. The Centres and Networks of Excellence are aimed at focusing strongly on human resource development and popularizing science in South Africa and across the African continent.

AIMS is an international initiative combining three Universities in South Africa, Cambridge and Oxford in the UK, and the University of Paris-Sud in France. Its goal is to strengthen scientific and technological capacity across the African continent. Initially it will focus on a unique residential nine-month postgraduate course developing strong foundations in mathematical research skills as well as providing an overview of many of the most exciting cutting edge fields in science.


The Flood, Noria Mabasa

The skills courses include: The Art of Scientific Approximation, Mathematical Problem Solving, Information Theory and Mathematical Modeling. There will also be review courses covering: epidemiology, geometry and topology, astrophysics, financial mathematics, quantum physics, fluid dynamics and other fields. The programme has attracted top lecturers from around the world who will be employing the most modern pedagogical techniques. The objectives are to develop strong mathematical and computing problem solving skills, to encourage innovation, and to build an awareness of the potential for science to solve problems of development.

> Mathematics possesses
> not only truth,
> but supreme beauty -
> a beauty cold and austere,
> like that of sculpture
>
> Bertrand Russell

Through advertising on the web, AIMS recruited 30 of Africa's top graduate students, from Algeria to Zimbabwe who, on completion, will boost the African networks of excellence. In time the student body will grow to 60. Students and lecturers are accommodated at the AIMS educational centre, allowing for maximum interaction. The centre has outstanding computer, library and lecture hall facilities.

According to the Director-General of the Department of Science and Technology, Dr Rob Adam, the department is confident the AIMS programme will contribute immensely to Africa' s social and economic development of its human resources and its participation in advancing science and technology. It will also optimise participation in the NEPAD Science and Technology framework, harnessing opportunities for development to eradicate poverty and underdevelopment in Africa.

The Minister of Science and Technology Dr Ben Ngubane and Minister of Education Professor Kader Asmal formally launched the AIMS programme. Senior government officials, academics and researchers from across Africa, international scientists including the UK's Astronomer Royal, Sir Martin Rees, attended the launch.
Full details of the project are on the AIMS website www.aimsforafrica.org.

Indigenous Knowledge Systems

Preserving knowledge, preserving our roots

Tom Suchanandan

Pursuant to the enactment of the constitution, the Parliamentary Portfolio Committee registered its commitment to the recognition, promotion, development, affirmation and protection of Indigenous Knowledge Systems (IKS). In accentuating the importance of IKS, Government has targeted the redressing of apartheid legacies through the provision of a Bill and Policy. In February 2001, the former Department of Arts Culture, Science and Technology (DACST) requested the Human Sciences Research Council to manage the redrafting of the Policy and Legislation. Perhaps we can just mention when the process started, the extensive consultation and the establishment of Directorate in DST.

In the light of the foregoing and in the absence of Indigenous knowledge legislation for recognition, affirmation, promotion, protection and development of IK, the policy recognises the trans-disciplinary nature of IKS and is underpinned by four drivers namely:

- Affirmation of African cultural values in the face of globalisation
- Development of the services provided by traditional healers
- Contribution of indigenous knowledge to the economy
- Interfacing with other knowledge systems

In addition, it takes into account all forms of indigenous knowledge and techniques that have survived the impact of colonialism, including the rich heritage of languages.

In the face of knowledge erosion and disappearance of traditions, protection accompanied by promotion and development should offer transmission incentives for IK holders, and encourage the promotion of informal innovations as a strategy for sustainable development. The protection of IK from unauthorized commercialisation, leading to income generation and the general upliftment of quality of life for rural communities is subsumed within the parameters of the Policy. In addition, it proposes the establishment of a national office on IKS (to formulate laws and regulations, relating to the potential of IKS), an Advisory Committee (understanding entities, studies with respect to the functioning of IKS) and a Development Trust (to harness revenue through benefit sharing protocols as well as targeting advocacy work). IKS funding streams that support research will be available via the national office of IKS to both researchers and IKS practitioners.

Berchemia discolor

The IKS Policy also proposes the creation of Indigenous laboratories and IK Centres in various areas of IK to ensure the active participation of public research and development institutions in IK protection.

To harness IK for development and trade, the Policy creates windows of opportunity by building national capacities in terms of raising awareness on the importance and potential of IK. Institutional and consultative mechanisms of IK protection and IK based innovation must be developed, to ensure a marketing niche for IK based products and for establishing incubation points within which IK holders can perfect their practice.

Like many developing countries, South Africa seeks to ensure that the benefits of cumulative innovation associated with Indigenous Knowledge accrue to its holders while enhancing socio-economic development. This is particularly true in the field of traditional medicines in which some of the most glaring evidence of expropriation and exploitation

have been and is still witnessed. The issue of access to and use of indigenous knowledge in medicine in particular is becoming central not least because of the huge implications of the economic benefits of such traditional knowledge.

In drafting the Policy, full recognition to the contribution of women as repositories of a large part of this indigenous knowledge is made. The fundamental role played by women in the application of scientific development to food production, health care, maintaining familial cohesion and other areas of IK is fully recognized and efforts to strengthen their understanding of scientific advances in these areas is made.

Tshumisano

Meeting the market halfway

Dr Deon de Beer

Masters students Grant Kruger and Calvin Blignault, at Port Elizabeth (PE) Technikon have created a solid phase joining technique, Friction Stir Welding (FSW) - the first of its kind to be internationally patented.

This unique process is used to join difficult to weld alluminium alloys in industry and is environmentally friendly. What makes Kruger and Blignault's achievement unique, is that they successfully converted and modified a conventional, second hand milling machine to operate as the basis of the friction stir welding machine. They also succeeded in making the FSW a fully automated process, which is controlled via computer.

The Port Elizabeth Technikon was the first tertiary institution in the Eastern Cape to be awarded a Technology Station by the then Department of Arts, Culture, Science and Technology (DACST), in 2001. The Department of Science and Technology has formed similar partnerships with seven technikons in South Africa, under the banner of Tshumisano Trust. Through Tshumisano Trust, the Technology Station Programme (TSP) was designed to strengthen and accelerate the interaction between Technikons and Small Medium Micro Enterprises (SMMEs), providing support for technology and innovation. The potential contribution of SMMEs to sustainable growth and employment creation is considerable, making a substantial contribution to the National System of Innovation. The TSP identifies technological innovation and related skills upgrading as being of vital importance to improved competitiveness, as well as improved participation in the innovation of South African SMMEs.

PE Technikon, through its Automotive Components Technology Station, is able to serve local and national SMMEs in the automotive component sector through the development of new processes and/or by evaluating existing materials and manufacturing processes. The facility

World class research - Master's students Grant Kruger and Calvin Blignault with the first friction stir weld on South African made 6mm thick aluminium alloy plate, at the PE Technikon. With them are their promoters Dr Danie Hattingh and Prof Theo van Niekerk who are National Research Foundation grant holders.

enables the Technikon to undertake world-class research. Friction Stir Welding has found various applications in a number of areas that include automotive components, space shuttle fuel tanks, aluminium decking for car ferries and manufacturing of compound aluminium extrusions. The advantages of Friction Stir Welding are that no filler material or external heat is required during the welding process, reducing consumable costs. Friction Stir Welding joints also exhibit an improved fatigue life compared to conventional joining techniques. South African technikons possess considerable potential for supporting innovation through the involvement of industry in both the learning content and in experiential learning of the students within industry. Dr Deon de Beer, chief executive officer (CEO) of the Tshumisano Trust said this creates the platform to deliver unique services, such as support of and technology transfer to SMMEs; and feedback into the teaching and R&D of industry's needs, to continue to deliver industrial oriented education.

This can be achieved through a shared-use principle, where Technikons make available their existing infrastructure, but necessary additions and upgrades can be made through the TSP, especially in cases where professional software licenses will be needed. "This implies that services to the industry will be delivered in a holistic approach, which often goes beyond the very focused Technology Stations at the participating institutions, and may also include multi-disciplinary support from within these institutions," said De Beer.

"Very important to especially the SMMEs, is the access and linkages to Government funding schemes of the dti and DST, as well as linkages to other Government Funded/Supported initiatives or institutions such as NAMAC, the CSIR, SABS, etc. Very often – especially in the SMME environment – small companies simply do not have the capacity to leverage these funding schemes or solicit support on their own. As a technology partner, the Technology Stations Programme can also facilitate this networking," he added.

Although this is a fairly young initiative, many positive results have already been produced. New and improved products and processes have already lead to increased turnovers, employment growth, more and larger contracts, and export opportunities – not to mention import substitution.

De Beer said South Africa is a unique country with unique problems. "We do however, also have a unique composition of people, showing a unique and innovative spirit to survive and win. Technologically, this unique character can be developed and supported to be one of the leaders in innovation – internationally" he said.

Contact details of the existing technology stations, as well as news on the programme development, can be viewed at: **www.tshumisano.co.za**

The support given by Automotive Components Technology Station (ACTS) in Port Elizabeth, has resulted in major contracts for Khaya Engineering, a BEE company in Port Elizabeth. Khaya may well become a supplier to a major assembler in the Automotive industry.

South Africa's hosts landmark Commonwealth science meeti

Joining heads for an African Solution

Daan du Toit

Following South Africa's successful hosting of the Africa, Caribbean and Pacific – European Union (ACP-EU) Forum on Research for Sustainable Development as well as the World Summit on Sustainable Development's (WSSD) Science Forum in 2002, the Department of Science and Technology was again entrusted with the organisation of a major international science and technology (S&T) event. On 11 and 12 June 2003, in his capacity as Chairperson of the Commonwealth Science Council (CSC)-21, Minister Ben Ngubane hosted in Sandton senior delegations from the CSC's thirty-six member countries, for the organisation's triennial high-level gathering.

CSC-21 was perhaps the most critical meeting in the organisation's history. Under Minister Ngubane's leadership, the CSC was tasked to consider and develop a response to the recommendation delivered in May 2003 by the Commonwealth Intergovernmental Committee (CIC), that the organisation should develop a renewal plan for its transformation into a more effective, dynamic and sustainable body. The CIC had been tasked by Commonwealth governments to review the mandates of all Commonwealth organisations and concluded that unless the CSC could be satisfactorily renewed, it should be dissolved. The renewal plan to be prepared by the CSC must accordingly be submitted for approval to the Commonwealth Heads of Government meeting, which will be held in Abuja, Nigeria in December 2003.

In order to provide appropriate political guidance and stimulus to these critical discussions, Minister Ngubane had deemed it appropriate to invite all Commonwealth Science and Technology Ministers to a Ministerial Gathering in Sandton held immediately prior to CSC-21 on 10 June 2003. More than twenty of his Commonwealth colleagues responded favourably to his invitation, thus, constituting the most powerful and August forum on S&T in the history of the Commonwealth. Following a fruitful reflection and exchange, the Ministerial Gathering adopted a Declaration committing the signatory countries to increased national and joint efforts in harnessing S&T for sustainable development. Within this context, they called for the CSC to be reconstituted as an effective resource to enable member countries to apply S&T platforms for growth and development.

A day prior to the Ministerial Gathering, in a further effort to foster a stimulating contextual background for debate at CSC-21, Minister Ngubane also convened a High-Level Forum, tasked to interrogate the "Challenges and Opportunities for Science and Technology in the Commonwealth." The Forum featured the participation of renowned international S&T policy experts such as Dr Kumar Bhattacharyya (United Kingdom), Paul Dufour (Canada), Prof Anil Gupta (India) and Prof Keto Mshigeni (Tanzania).

This full programme of events also included two side events for Ministers responsible for Science and Technology in the Southern African Development Community (SADC). The SADC Ministers concluded their Sandton meetings by adopting a Declaration re-emphasising their countries' commitment to enhanced regional collaboration and coordination in S&T, as well as a more pronounced role for S&T in continental initiatives such as the New Partnership for Africa's Development (NEPAD.) Their regional Ministers also participated in a briefing on and committed their countries' support to the Southern African bid to host the Square Kilometre Array (SKA) radio telescope.

The main business at hand was, however, of course the future of the CSC. A strong message resonated from both the Ministerial Gathering and the CSC-21 meeting proper, that the CSC should not be abandoned, as some external critics had proposed, but instead be renewed and strengthened, thus, improving the organisation's ability to render S&T policy advice to, and promote S&T capacity building and innovation in, as well as foster collaborative partnerships among its member countries. To accomplish these goals, CSC-21 mandated a Task Team, to be co-chaired by South Africa and India, to develop the required Renewal Plan.

Since CSC-21, the Task Team has been making significant progress in the preparation of the Plan on which we will report in future editions. Internet link - http://www.dst.gov.za

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PBMR prototype plant

(cont. from P. 5**... *PBMR)***

since nuclear power generation produces no carbon dioxide emissions, smoke or any other gases. France's carbon dioxide emissions from electricity generation fell by 80 percent between 1980 and 1987 as its nuclear capacity increased, and Germany's nuclear power programme has saved the emission of over two billion tons of carbon dioxide from fossil fuels since it began in 1961.

Dr. Lennon explains that large thermal, nuclear or hydro-electric power stations require lead times of up to eight years and could have surplus capacity if economic growth is not as expected. "In addition, a new coal-fired plant could cost up to R40 billion, while a conventional nuclear plant like Koeberg would cost about R20 billion."

The PBMR, with its lead-time of only two years, low operating cost and fast load-following characteristics, poses a potential solution to this dilemma.

The South African economy could benefit on an unprecedented scale from the PBMR. If as few as 10 modules per year are exported, the project could contribute up to R8 billion to the local Gross Domestic Product (GDP) and R10 billion per year in exports. In addition, about 57 000 direct and indirect jobs could be created. These numbers will double if 20 modules per year are exported and triple if 30 are exported. **Internet link-https://www.pmbr.com**

Postscript

Postscript

Dear Reader

I would like to thank you for your responses and feedback on the first volume of our magazine - 'Innovation for Development'. I hope this volume was enjoyable and informative to you. Such is the nature of science and innovation, that we learn something new everyday. We would also like you to interact with us via e-mail or post your opinions to us. We would like to know what your views are on this edition's content or on Science and Technology topics.

More and more, DST embarks on very exciting projects, coupled with interesting and beneficial agreements with countries, such as Japan. In the following issues of the magazine, you can expect at least one feature story on astronomy, international news and focus on one of our poverty alleviation projects.

Our next issue will feature the Coelacanth, colloquially known as a dinofish. This fish is said to be older than dinosaurs. The Coelacanth, which was spotted in the late 1930s by a recreational diver, remains a protected species in South Africa. Innovation will also bring you an update on the Nepad Ministerial Workshop held in November and the latest on the recently launched Advanced Manufacturing Technology Strategy.

The magazine is now available on the DST website at http://www.dst.gov.za/magazine/default.htm.

Contributions may be forwarded to Innovation's Editor: Buhle Khumalo, at Buhle.Khumalo@dst.gov.za.

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Picture sources:

- DEAT & SANAP
- HartRAO
- CSIR
- DST