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Scope

Science and technology
in support of small, medium
and micro enterprises

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Committed to supporting small, medium and micro enterprises

South Africa has to grow its economy to counter unemployment, poverty and inequality. One of the ways in which this can be done, is through the creation of an enabling environment for small, medium and micro enterprises (SMMEs).

Government's commitment to this goal is reflected in the Nine-Point Plan – announced in the 2015 State of the Nation Address – to boost economic growth and create jobs, with the inclusion of plans to unlock the potential of SMMEs, cooperatives, townships and rural enterprises.

For the CSIR to deliver on its mandate of contributing to the improvement of the quality of life of South Africans through directed, multidisciplinary research and technological innovation, it has to support the SMME sector. While the organisation has a long and established track record in supporting and developing enterprises, it has been rewarding to see the early successes of the Industry Innovation Partnership Fund, which is supported by the Department of Science and Technology. This programme provides entrepreneurs with access to specialised facilities and skills, allowing them to realise their business ambitions.

The different aspects of the CSIR's support to SMMEs are extensively outlined in the introductory article on pages 4 – 9. The articles in this edition of *ScienceScope* have been clustered around the various modalities of our support viz. access to infrastructure, support for enterprise creation, enterprise supplier development, localisation, skills development and training, as well as empowerment through licensing.

This support is, without exception, made possible through financial support and other commitments from a variety of government departments, notably the Departments of Science and Technology, Trade and Industry and Rural Development and Land Reform, as well as a number of provincial departments and funding agencies. We hope that our role in developing and supporting SMMEs will grow and that ultimately, the country will see a strengthening in the contribution of SMMEs to job creation, poverty alleviation and equality.

DR THULANI DLAMINI
CSIR CEO



We hope that the country will see a strengthening in the contribution of SMMEs to job creation, poverty alleviation and equality.

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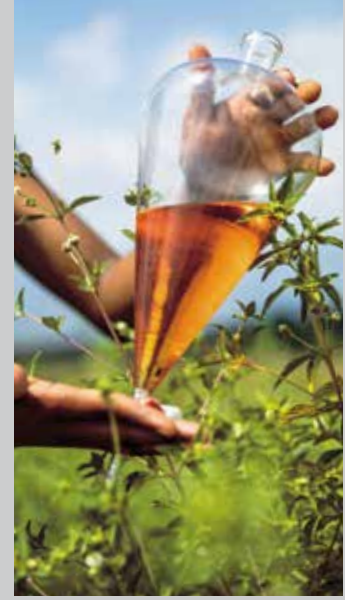
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Essential oil produced by the Temothuo cooperative in Driekop in Limpopo's Sekhukhune district. Temothuo is establishing an agro-processing enterprise that aims to produce essential oils for manufacturers of perfumes, cosmetics, aromatherapeutic products and natural remedies. The cooperative is supported by the Department of Rural Development and Land Reform, which contracted the CSIR as an implementation agent for the production facility.

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Science and technology in support of small, medium and micro enterprises

The CSIR is committed to using its knowledge base to help improve the quality of life of all South Africans. One of the ways in which this can be achieved, is focusing on national priorities such as job creation, inclusive economic growth, as well as poverty reduction and rural development, specifically in the context of small, medium and micro enterprises (SMMEs).

The CSIR is able to make an impact in this regard by providing SMMEs with access to specialised infrastructure and multidisciplinary skills in priority sectors, developing new enterprises through feasibility studies and incubation support, facilitating training and skills development, supporting existing SMMEs by optimising processes and products as part of localisation and supplier development initiatives, as well as by licensing CSIR-developed technologies to SMMEs.

Access to the CSIR's multidisciplinary skills and infrastructure

The CSIR supports new enterprises by providing them with access to the organisation's specialised facilities and multidisciplinary skills as part of the Industry Innovation Partnership Fund, which is supported by the Department of Science and Technology (DST). This means that SMMEs that would otherwise not be able to afford it, have access to large-scale prototyping and pre-commercial manufacturing infrastructure, equipment, expertise and access to business and technical networks. The SMMEs can put their innovations through a process of laboratory-scale validation, technology prototyping and pilot manufacturing.

(Right) Brighton Msonza, who specialises in enterprise development and agro-processing projects at the CSIR, and Michael Molenke (right), a worker on the Tolane farm north-west of Rustenburg, hold fibres produced from sisal plants.





SUPPORTING SMMEs IN THE BIOECONOMIC SECTOR

One example of this type of support is through the CSIR Biomanufacturing Industry Development Centre (BIDC), a biomanufacturing innovation hub that supports SMMEs with the development of new technologies and products.

“The CSIR helps to convert new technologies into market-ready biological products, such as food, cosmetic or water and sanitation products. SMMEs might approach us with challenges, for example, a limited shelf-life for existing products, an ingredient that needs to be replaced or a desire to extend their product ranges. We also optimise and validate their manufacturing processes and make sure that their products meet regulatory, client or industry specifications,” says the CSIR’s Dr Dusty Gardiner, manager of the BIDC.

The CSIR provides access to experts in bioprocess development, product prototyping, scale-up and manufacturing. The organisation also houses laboratories for molecular biology, applied biochemistry, biocatalysis and fermentation, as well as laboratory and pilot-scale process development that can be mobilised to support SMMEs.

To date, the BIDC has supported 23 SMMEs, transferring 70 products and creating 150 permanent jobs.

The CSIR provides similar models of support in the fields of nanotechnology, biorefining and photonics.



Enterprise creation

To enter and be competitive in the marketplace, SMMEs need services and products of good quality, sound business plans, reliable manufacturing processes and a well-targeted marketing strategy. The CSIR has the expertise and infrastructure to support the full process of enterprise creation.

“The CSIR offers a one-stop integrated service to public and private sector institutions committed to broadening economic participation,” says Boyse Pillay, who heads the organisation’s work in enterprise creation for development. “We operate with a development mandate in partnership with SMME development funders. Such funders include national, provincial and local government, international agencies, private corporate social investment initiatives and foundations.”

“The work starts with the identification of an opportunity. A multidisciplinary team would typically conduct a study to identify potential economic development opportunities in a geographical area or be commissioned by a government department to conduct a sector study, for example, in the textile industry.”

The next steps include conducting feasibility studies and developing business plans.

“The core focus of our work then shifts to enterprise creation, incubation and supporting the SMMEs to become suppliers to both public and private sector clients.”

Through the incubation process, the CSIR remains involved in these new enterprises over an extended period through training, mentoring, as well as technological and management support until they are fully operational and functioning independently.

introduction



The CSIR is helping the City of Tshwane realise its vision of stimulating economic township development through the establishment of the Tshwane Business Process Outsourcing Park in Hammanskraal. (Above) Loyiso Nxumalo of the CSIR (left) and Solly Shivambu, Fikile Construction Project Manager.



Empowering SMMEs in the built environment

Small, medium and micro enterprises are a critical part of innovation and change in the building sector, says Sihle Dlungwane, CSIR research group leader for building science and technology.

"The CSIR looks at innovative building technologies, renewable energies and energy efficiency in this sector. Our experts include materials, industrial, civil and structural engineers, as well as architects and construction managers," says Dlungwane.

"SMMEs can play an important role in building processes and materials manufacturing and our role is to provide them with suitable skills to do that. One example of how innovative products in this sector can empower SMMEs, is a green brick that does not need ordinary cement. It is cheap and cost-effective to produce and can therefore be produced by SMMEs at small plants. We take SMMEs through the journey, providing training, guidelines, advice and tools," he says.

“ SMMEs CAN PLAY AN IMPORTANT ROLE IN BUILDING PROCESSES AND MATERIALS MANUFACTURING. OUR ROLE IS TO PROVIDE THEM WITH SUITABLE SKILLS TO DO THAT. ”

Sihle Dlungwane
CSIR research group leader for
building science and technology



The CSIR's Dr Mike Masukume (left) and Jan Mentz of Greenfield Additives discussing the use of nanotechnology for the making of stabilisers for the production of plastics.

Enterprise supplier development: Empowering SMMEs in the aerospace sector

The Aerospace Industry Initiative (AISI) is an initiative of the Department of Trade and Industry, managed and hosted by the CSIR with the specific aim of improving the competitiveness of the local aeronautics, space and defence sectors.

"Our agreement with the department is to make our expertise and facilities available to industry with a specific focus on SMMEs," says CSIR aerospace key account manager, Marié Botha.

"Aerospace is strictly regulated, for example, SMMEs do not provide directly to an aircraft manufacturer like Airbus. Instead, they have to work through Denel or Aerosud. Our focus is to empower their SMME networks.

"The CSIR sources capability requirements from original equipment manufacturers and works with SMMEs to improve and maintain their standards. This typically involves technology transfer to these SMMEs."

One example is the transfer of gas turbine engine technology and skills to an SMME in Cape Town.

"The CSIR also supports SMMEs with technology validation and derisking by offering them access to our expertise and infrastructure, for example in the case of additive manufacturing for which the infrastructure requires significant capital that an SMME would not typically have access to," says Botha.

introduction



Uraisha Ramlucken, a PhD student registered at the University of Pretoria and supported through a Department of Science and Technology bursary, developing technologies for advanced eco-friendly products at the CSIR.

Empowering SMMEs through licensing

The CSIR has a large number of technologies with commercial potential as an output of its research and development (R&D). It actively seeks businesses and entrepreneurs to exclusively or non-exclusively license rights to commercialise these technologies, creating valuable products and services for the market. This is the impact the CSIR aims to achieve through technology transfer.

// Investing in, creating and growing high-tech SMMEs has become the lifeblood for growing our economy and creating jobs," says Nicki Koorbanally, CSIR manager for licensing and ventures.

"In alignment with the Intellectual Property Rights from Publicly Financed Research and Development Act, 2008, the CSIR's technology transfer policy supports the commercialisation of technologies through small enterprises and broad-based black economic empowerment entities. Rather than purely financial returns, our main objective is to transform the industry and promote more prolific use and uptake of technologies in the market. Any royalties that we generate (normally a percentage of revenue generated by the licensee) serve as a minor return on our R&D investment."

In a bid to lower transactional costs and barriers for SMMEs to access technologies, the CSIR has introduced an Instant Access Licence, modelled on Stellenbosch University's programme. This is essentially a non-exclusive option agreement for a limited duration (three months to three years), with a nominal royalty (typically 1%), and an option to negotiate a full licence during the term of the agreement. This approach should ease the burden for small businesses that often find it difficult to negotiate licence agreements without proper legal representation.

Koorbanally says that the objective is to position the CSIR as a technology licensor of choice.

"The CSIR is able to solve complex problems with its multidisciplinary expertise and infrastructure, and we encourage partnerships with potential licensees early on in the R&D process to ensure that we are solving real, relevant needs of the industry."



Manufacturing companies that benefited from technical assistance packages are now able to supply to large infrastructure projects like the Square Kilometre Array and Transnet's locomotive localisation project.



Supplier development and localisation

The CSIR is assisting the DST with the implementation of its Technology Localisation Plan. This is done through a unit for technology localisation hosted and managed by the CSIR. The plan, which is closely aligned to government's Competitive Supplier Development Plan, ties in with the infrastructure rebuild programme of the country and therefore provides numerous opportunities for localisation and industrialisation.

Government is driving local content in all state procurement tenders. In many instances, the contracts awarded by a state-owned company will go to an original equipment manufacturer (OEM) that is based outside of South Africa. These OEMs need to identify and work with South African-based manufacturing companies to achieve the local content requirements of these multi-million rand projects. However, to a large extent, the OEMs are not aware of all the companies and capabilities that exist in the South African manufacturing industry and capabilities or systems are inadequate in cases.

The Technology Localisation Implementation Unit (TLIU) at the CSIR provides support to local manufacturing companies to close the gaps and enable companies to participate in the projects being rolled out. The gaps at the companies are identified by conducting technology capability assessments and developing appropriate technology interventions, which include technology transfer, product development, manufacturing systems developments, high-end technical skills development and quality management systems.

The TLIU has also established technology centres that provide sectors with access to high-end specialised technology. These centres are established using the existing infrastructure of the DST and through a partnership with a technology provider. Companies use these centres mainly for product development and testing linked to localisation. These centres also provide support for product development through testing and prototyping.

THE TECHNOLOGY LOCALISATION IMPLEMENTATION UNIT AT THE CSIR PROVIDES SUPPORT TO LOCAL MANUFACTURING COMPANIES TO CLOSE THE GAPS AND ENABLE COMPANIES TO PARTICIPATE IN THE PROJECTS BEING ROLLED OUT.



access to infrastructure

The CSIR's Nano-materials Industrial Development Facility hosts equipment and expertise that can play an important role in the development of small, medium and micro enterprises whose products will benefit from nanomaterials components.



Synthetic hydrotalcite nanoclay produced by Greenfield Additives at the CSIR.

Bridging the innovation chasm with nanotechnology

The CSIR and the Department of Science and Technology (DST) have launched a production facility that can assist small, medium and micro enterprises (SMMEs) in need of scale-up facilities to accelerate the development and commercialisation of chemical and nano-based technologies.

"Our current focus is on cosmetics, polymer and chemical formulations, and progressing to manufacturing on a semi-industrial scale. We use nanotechnology as a key enabling technology to enhance the competitiveness of conventional technologies," says the CSIR's Dr Mike Masukume, who manages nanostructure scale-up at the facility.

He says that the CSIR has expertise in the latest technologies and understands the challenges and opportunities in this technological space.

"We can provide SMMEs with access to a versatile scale-up plant with equipment such as autoclave reactors, filtration systems, a wet mill, process

tanks and a rotary dryer to allow the users to produce products on an industrial scale," says Masukume.

"We provide access to a skilled workforce with the right technological expertise in process development and scale-up. Researchers at the CSIR are knowledgeable about what happens to materials at the nano-scale and how the special properties, such as surface-to-volume ratio and reactivity, can be utilised in applications. They have a sound understanding of how engineering properties such as heat and mass transfer, as well as flow properties, must be considered during the scale-up of materials. The facility, which is part of the DST-CSIR Centre for Nano-Structured Materials Centre, also facilitates access to state-of-the-art instruments to characterise products during scale-up for rapid optimisation and quality assurance analysis."



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The CSIR's Dr Mike Masukume (left) and City Seokane, chief operating officer of Clean Carbon Technologies, discussing an experimental carbon nanotubes manufacturing set-up.



GREENFIELD ADDITIVES: MANUFACTURING A STABILISER FOR THE PRODUCTION OF PLASTICS

Greenfield Additives, owned by Jan Mentz and funded by the Industrial Development Corporation of South Africa, is developing nanotechnology that could, in the future, be used in the making of a stabiliser for the production of plastics such as polyvinyl chloride, polyethylene or polypropylene.

"Our technology is a nanostructured, layered double hydroxide that acts as an acid scavenger during production. Currently, this type of product is imported, but we believe it can be produced locally at a lower cost and custom-made for the local environment where one also has to develop ways to recycle scrap and products of overruns," says Mentz.

"Prior to the scale-up facility, my biggest challenge was to make sufficient material of good quality for market development. This is a critical step between the research and industrial phases. At the CSIR, I have access to the necessary production facilities and testing laboratories and I am already conducting trials with a client who manufactures polymer additives."

CLEAN CARBON TECHNOLOGIES: MANUFACTURING CARBON NANOTUBES

One of the SMMEs supported by the CSIR, Clean Carbon Technologies, develops technology to capture carbon emission waste and convert it into carbon nanotubes.

"Carbon nanotubes have unusual properties, which are valuable for nanotechnology, electronics, optics and other fields of materials science and technology," says City Seokane, the chief operating officer.

"The properties of carbon nanotubes include excellent thermal conductivity, mechanical strength and electrical conductivity. They have many potential applications in energy storage, as well as products such as automotive parts, boat hulls, sporting goods, water filters, thin-film electronics, coatings, actuators and electromagnetic shields."

Seokane says that while the global demand for carbon nanotubes is not met, the South African market for carbon nanotubes is relatively small.

"In addition to difficulties to access the international market, challenges include costly production methods, access to funding for expansion, as well as a lack of proper facilities and expertise," he says.

"The CSIR provides us with access to world-class laboratory facilities for sample characterisation at minimal cost. Its production facilities are already zoned for our purpose and we also have access to advice and mentorship from the organisation. Furthermore, we have an opportunity to collaborate and develop the South African carbon nanotube market with the CSIR."

Calls for participation – The CSIR issues regular calls to invite companies to approach the Nano-materials Industrial Development Facility (NIDF) for support. "These applications are then considered by a steering committee to make sure that our resources are fairly allocated," says Dr Manfred Scriba, CSIR programme manager at the NIDF. Scriba says the calls are published on the CSIR website and he encourages interested parties to regularly visit the website – www.csir.co.za.

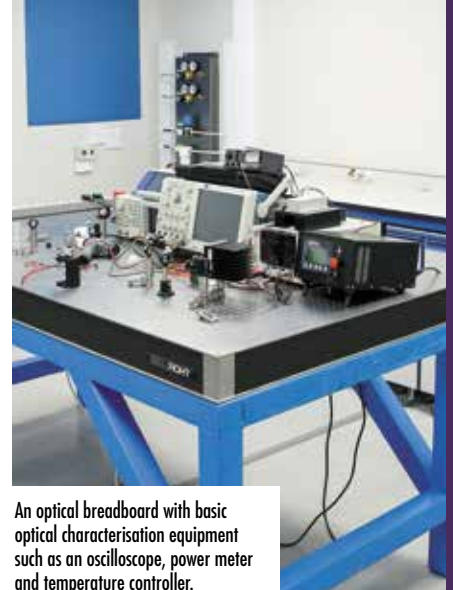
< Jan Mentz, owner of Greenfield Additives and the CSIR's Dr Mike Masukume.

access to infrastructure

A new leading-edge photonics facility is at the heart of a drive to stimulate the growth of the photonics industry in South Africa. Coupled with technical support, the Photonics Prototyping Facility will act as a catalyst to build a globally competitive photonics industry in South Africa. It is envisaged that the initiative could lead to the strengthening and formation of small, medium and micro enterprises in this field.



Equipment in the newly established Photonics Prototyping Facility includes a drill press for drilling into different materials.



An optical breadboard with basic optical characterisation equipment such as an oscilloscope, power meter and temperature controller.

New national facility to help grow and foster photonics enterprises

Funded by the Department of Science and Technology (DST) and located at the CSIR, the Photonics Prototyping Facility (PPF) will stimulate the growth and competitiveness of the South African photonics industry.

Photonics is the science and technology of generating, controlling and detecting photons, which are particles of light. It underpins the technologies used in smartphones, laptops, data communication and medical devices. It is said that the 21st century will depend as much on photonics as the 20th century depended on electronics.

Currently, the challenge in the South African photonics industry is that there is a fragmented research, development and innovation value chain experienced across the industry sectors, with only

certain niche areas boasting a complete value chain from design to engineering, manufacturing, testing, implementation and maintenance. The major contributing factors for this include low local content within the sectors, sectors often dominated by imports, limited collaboration between stakeholders, as well as limited manufacturing capabilities as a result of a lack of infrastructure and expertise.

“Through the establishment of the PPF, we hope to mitigate some of these challenges by providing world-class infrastructure, facilities and skilled manpower to fast-track the prototyping process,” says Khomotso Duiker, manager of the facility.

The facility will provide the photonics research community and industry with sufficient support and opportunities



“ The objective of the Photonics Prototyping Facility is to bridge the innovation chasm that currently exists in the market. It will serve as a bridge for technology transfer and commercialisation. ”

Khomotso Duiker
PPF business area manager



Equipment used to extract heat from laser sources.

to take developed technologies to a point of market-readiness. In addition, it will provide a platform for photonics research communities and industries to perform testing, characterisation and evaluation of technologies developed in the facility, with the added benefit of limited manufacturing production runs of photonics products and testing of products to support commercialisation.

Duiker says the purpose of the PPF is not to serve as a manufacturing facility that competes with industry, but to help stimulate and grow the existing photonics industry, as well as support new start-ups by providing them with access to world-class facilities, equipment and scarce skills.

In an effort to include SMMEs in the growth and development of the photonics industry, a two-day photonics workshop was held earlier this year. The workshop assisted photonics SMMEs, industries and entrepreneurs to shape their business ideas and create successful strategies for their photonics-based technology.

The workshop was facilitated by a CSIR Entrepreneur in Residence, Neil Hinrichsen, who has a sound track record in commercialising technologies.

The photonics workshop also served as a platform to introduce participants to equipment and facilities in the PPF, funding options, incubation facilities at Gauteng's Innovation Hub and industry and government contacts.

“The workshop was successful and it served the attending SMMEs, entrepreneurs and industries well in that it provided them with the platform to engage, create meaningful relationships and expose them to the developments currently taking place in the photonics industry,” says Duiker.

The PPF comprises premier facilities (three class 1 000 clean rooms), access to skilled resources (optical and industrial engineers, as well as photonic scientists) and characterisation equipment (diagnostic equipment, optical components and laser sources).

To date, one of the first outcomes includes the development of a miniaturised laser system for laser range-finding applications for a military client.

 **KHOMOTSO DUIKER**
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The PPF invites entrepreneurs, scientists, engineers, industries and investors to approach the facility about photonics-related prototype development. Contact Khomotso Duiker (ppf@csir.co.za) for additional information or to arrange a viewing of the facility.

A milling machine for general engineering machining.



access to infrastructure

COMPANIES THAT ARE INCUBATED AT THE BIDC HAVE ACCESS TO READY-TO-USE BIOMANUFACTURING FACILITIES

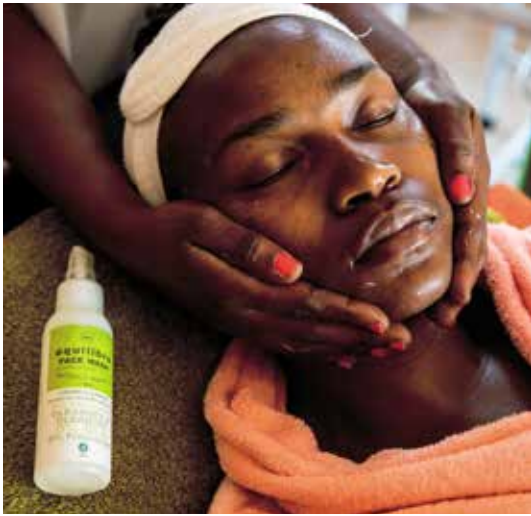


Supporting SMMEs in the biomanufacturing sector

The CSIR Biomanufacturing Industry Development Centre, a first of its kind in South Africa, was established in 2013 to support small, medium and micro enterprises involved in bio-manufacturing to meet their customers' needs in short time frames and to exploit market opportunities.

The CSIR Biomanufacturing Industry Development Centre (BIDC) was officially launched by the Minister of Science and Technology, Mrs Naledi Pandor, in May 2016. The centre supports small, medium and micro enterprises (SMMEs) through the development of bio-based manufacturing processes and products. Companies that are incubated at the BIDC have access to ready-to-use biomanufacturing facilities, support in the use of research and development (R&D) laboratories, as well as access to experts in the fields of agro and bio-processing product development and scale up.





Marple Skin Care is one of the enterprises supported by the B IDC in the cosmetic sector. Judith Moralo, managing director at Marple Skin Care (centre) and her employees display a selection of cosmetics products.



BIOMANUFACTURING EXPERTISE TO GROW A FORTIFIED SKIN CARE ENTERPRISE

Marple Skin Care, one of the B IDC-supported enterprises, is a manufacturer of skin care products that are fortified with indigenous African oils and butters. The enterprise's products include the Vintage and *équibré* ranges.

"Our Vintage product range is inspired by vintage designs and indigenous oils as well as butters to address skin concerns, whereas our *équibré* product range is about combining biosciences R&D and indigenous knowledge," says Judith Moralo, managing director at Marple Skin Care.

Marple Skin Care is one of the enterprises supported by the B IDC in the cosmetic sector. The B IDC's interventions vary depending on the needs of the particular enterprise.

"The B IDC assisted us with further development of existing products, as well as with the R&D of new products," says Moralo. "Not only were new products developed, the B IDC also assisted with dermatological tests, scientifically validated our formulations and manufactured market samples."

The CSIR played a significant role in improving the competitiveness of Marple Skin Care's products. The organisation ensured that Marple Skin Care's products stand out in the market by scientifically validating the enterprise's product claims, thereby enhancing its unique selling proposition. This enabled Marple Skin Care to suitably position itself and its offerings in the market to differentiate itself from its competitors.

Moralo says, "Marple Skin Care is more confident in its product offering. The enterprise's products are fully tested and compliant with international regulations."

"This enables us to confidently market our products in highly regulated markets both locally and internationally. The market now has more confidence in our product and brand, which has translated into an improvement in the leads we've been generating and thus we anticipate an increase in revenue."

Achieving full employment, work and sustainable livelihoods is the only way to improve living standards and ensure a dignified existence for all South Africans. Since its incubation at the B IDC, Marple Skin Care has created three permanent jobs and one temporary job. The enterprise has contributed to the creation of indirect employment through the growth of the enterprise's supply chain.

"The enterprise's growth target for the first year after the CSIR's intervention is set to double the size of business and if the first three months is anything to go by, we are on track to achieve this target," she adds. "However, our future plans do not only include growing our market share in the local market, but also increasing our reach and presence in international markets. Marple Skin Care's growth focus is to expand its market penetration through online platforms."

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Supporting SMMEs in the biomanufacturing sector cont.



A bioreactor in the Biomanufacturing Industry Development Centre based at the CSIR.

BIOMANUFACTURING EXPERTISE TO GROW A RECOMBINANT PROTEINS ENTERPRISE

Without the B IDC, Dr Santosh Ramchuran's dream of manufacturing high-value recombinant proteins that are used as a raw material for the production of biopharmaceuticals would have remained just that – a dream.

Ramchuran, who completed his PhD in biotechnology at Lund University in Sweden, has over 15 years of experience in science, engineering and technology development. He established his company, JVS BioTech, in 2013 and is based in KwaZulu-Natal.

"This biotechnology start-up focuses on demonstrating South Africa's capabilities in the manufacturing of high-value recombinant proteins. Recombinant proteins are proteins encoded by a gene – recombinant DNA – that has been cloned in a system that supports the expression of genes and translation of messenger RNA," says Ramchuran. "The company has acquired the rights to develop and manufacture a portfolio of high-value products including cytokines, growth factors, diagnostic enzymes and viral antigens from a UK-based company."

The B IDC has been instrumental in providing the necessary resources in terms of infrastructure, equipment and technical expertise required to develop these product leads and turn them into commercially viable products. With the assistance of the B IDC, JVS BioTech was able to validate its technology and ensure that it was feasible – from a techno-economical perspective – to manufacture locally.

In terms of one of their product leads, the company has gone from 'clone to commercial' in two years, which is a remarkably short time period for these types of products.

Ramchuran says that the primary goal for JVS BioTech is to establish South Africa as a key manufacturing and development destination for well-characterised, competitively-priced recombinant proteins.

Products produced by JVS Biotech at the B IDC in Pretoria.

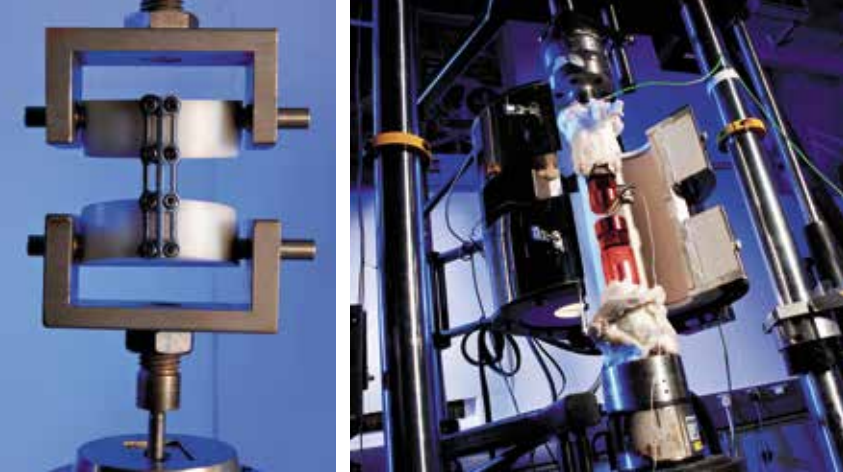


The company envisages that its incubation through the BICD will enable it to move from having a core competency in bio-manufacturing to a distinctive competency in the development and manufacture of recombinant proteins for world markets.

Ramchuran is adamant that without the help of the BICD, JVS BioTech would not have stood a chance in this high-end competitive manufacturing space. This is mainly due to the high cost of capital required – estimated at R15m to set-up a small bio-processing facility.

“The current model of incubation at the BICD allows companies similar to JVS BioTech access to high-end equipment and expertise in bioprocessing that is required to establish a proof of concept. More importantly, the current setup at the BICD allows companies to produce qualified market samples, which is a requirement by big-pharma prior to testing any recombinant products at their facilities,” notes Ramchuran.

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Fatigue testing of a titanium-made medical implant and (right) high-temperature low-cycle fatigue testing of turbine blade material.

CSIR interventions in the field of light metals set to benefit SMMEs

The CSIR has created a platform to enhance and contribute to the sustainability of small, medium and micro enterprises in the light metals and manufacturing sector.

The CSIR's light metals research group has been providing product and process development support to South Africa's small, medium and micro enterprises (SMMEs) over a number of years.

The focus has primarily been on two metals, namely titanium and aluminium. The primary objective relating to titanium is to establish a local titanium industry, with significant potential for SMMEs to become part of the titanium value chain. Earlier, the CSIR launched a titanium pilot plant following the development of a novel, CSIR-patented process to produce primary titanium metal.

While South Africa has large reserves of titanium-bearing minerals, the ability to economically extract the mineral from the mineral concentrate, using the CSIR process, will help create a new downstream industry. Work in this regard has largely been funded by the Department of Science and Technology and through the formation of the Titanium Centre of Competence.

The development of a South African aluminium industry roadmap has paved the way to double the size of this industry by 2030. Currently, the aluminium industry employs 11 700 people directly and 28 900 indirectly. Processes and systems are being rolled out to double these numbers by 2030.

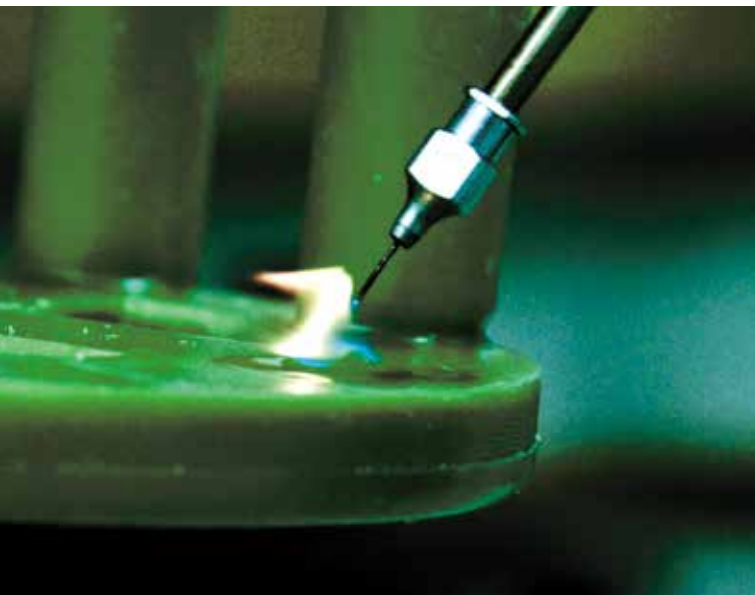


"Government's financial support and the CSIR's technological interventions could see many spin-out companies emerge in this space in the next five years," says CSIR senior researcher and project manager, Neels Babst.

Light metals experts at the CSIR have been instrumental in product development and process improvement interventions for various metal component manufacturers. These enterprises have benefited through improved competitiveness that gave them access to wider markets, enabling them to compete globally.

Furthermore, the CSIR is exploring the establishment of an industry development centre for incubating and providing a tolling manufacturing capability for SMMEs.

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The CSIR's light metals research team is made up of highly experienced and qualified researchers with access to advanced infrastructure for innovation and manufacturing. Specialised facilities and capabilities for materials (metals and composites) design, selection, testing and characterisation are available. (Above and below): The CSIR's investment casting facility.



ENTERPRISES THAT HAVE BENEFITED FROM CSIR ASSISTANCE IN THE LIGHT METALS DOMAIN:

Saetra Health Solutions – The CSIR did beta annealing of Ti6Al4V Gr23 for Denel as no local suppliers could do it successfully. The required quantity was delivered with all the required quality documentation.

Ametex – The CSIR casted white cast iron creep samples for a joint project with Magma Germany to develop material properties for the specific grade of white cast iron used in the South African industry as an update to the magma simulation package in South Africa. Previously, industry could not cast to the required process control levels.

Caudwell Marine – The CSIR casted a prototype of an inlet and outlet manifold for a supercharger on a Nissan GTiR engine for marine applications.

Paltech – The CSIR assisted Paltech in the redesign and manufacture of aluminium valves for transformers supplied to the electrical industry. The valves have been tested and approved by Powertech Transformers, the transformer manufacturer.



The CSIR assisted with the redevelopment and manufacturing of a new aluminium valve (left), which was launched at the premises of Powertech Transformers (Pty) Ltd. From left are Conrad Atsell, Paltech; Fanie Henning, Paltech; Len Klassen, Paltech; Johan Jordaan, Powertech Transformers; Larise Godwin, Paltech; Martin Williams, CSIR; Filipe Pereira, CSIR; Ally Vusi Mahlangu, CSIR and Richard Burton, Paltech.

access to infrastructure



The CSIR's competence in laser refurbishment based on laser cladding technology was displayed at an open day for small, medium and micro enterprises.

CSIR introduces laser-based approach to support SMME development

Over 30 small, medium and micro enterprises from across Gauteng were introduced to laser-based manufacturing technologies that can support their manufacturing operations at an open day organised by the CSIR.

Dr Luyolo Mabhali, CSIR research group leader for laser-enabled manufacturing, says the open day was hosted to introduce laser-based manufacturing technologies and processes as a viable advanced manufacturing solution to local manufacturers.

“Laser-based manufacturing provides designers and manufacturers with a new manufacturing technology to improve the competitiveness of product lines, as well as improve on turnaround times,” he says.

Other than introducing small, medium and micro enterprises (SMMEs) to laser-enabled manufacturing technology and services, small companies also had an opportunity to engage with CSIR researchers on some of their technical challenges that can be addressed with laser-based processing techniques.

Small business owners who attended the open day said they found it informative. “As a business owner in the jewellery industry, I was particularly interested in laser cutting and welding. I think these laser technologies can be of great use to my business. The platform also provided us with the opportunity to network. I look forward to having a follow-up meeting with the CSIR and the Small Enterprise Development Agency to further explore possible business opportunities,” says Hennie Boshoff, owner of Bossau Finesse Jewellery.

Over the years, the CSIR has successfully developed laser-based manufacturing technologies that enabled industry to develop new products.

“We understand that the cost of using laser-based technologies are high for most SMMEs. To bridge the gap, we are offering our capabilities, which include access for SMMEs to our laser-based manufacturing equipment, and expertise to support them in new process development ventures for their manufacturing processes,” says Hardus Greyling, commercialisation manager at the CSIR National Laser Centre.

The CSIR also offers a number of other laser technology solutions and services for SMMEs, such as laser welding, laser hardening, laser cladding and 3D laser cutting, as well as a mobile laser system for on-site processing applications.

“These diverse technology solutions have the ability to reduce costs, enhance performance, provide opportunities for innovative design and extend the lifespan of equipment in the industrial market,” adds Greyling.

The CSIR also renders laser technology assistance to companies in the automotive, aerospace, tooling and power generation manufacturing industries.

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Helping a community to optimise their water bottling plant

The CSIR is assisting a local community cooperative in Mpumalanga in upgrading their water bottling factory and to market their products in local towns. The role of the CSIR includes conducting a due-diligence study of the built-up factory, the development of an implementation, budget and business plan, as well as the setting up and commissioning of operations at the plant. This includes equipment and process upgrades, water testing, setting up a water testing laboratory and supporting the cooperative until a fully functional company is set up and running.

The Donkerhoek Water Bottling factory is situated on a farm in a picturesque part of rural Mpumalanga near Ermelo, Volksrust and eMhondo, previously called Piet Retief. The Mpumalanga Department of Economic Development and Tourism supported the local cooperative to establish the factory with the intention to bottle water from a borehole on the farm, but they needed support to optimise their processes and business plan.

“In 2014, the Department of Rural Development and Land Reform requested the CSIR to conduct a due-diligence study on the business and then contracted us to implement our recommendations,” says Brighton Msonza, CSIR mechanical engineer and senior enterprise development specialist who leads this CSIR project.

“The cooperative consists of 21 people who represent families in the region. The department wanted the delivery of a fully functional water bottling plant that would provide viable job opportunities and a sustainable income to the community.”

The CSIR’s recommendations included that the business should apply for waste management and water-use licences and that a proper market, technical and financial analysis be conducted and a business plan prepared.

“The CSIR conducted a needs survey at businesses in Ermelo, Volksrust and eMhondo and proposed that the water be bottled in 340 ml, 500 ml and 1 L bottles. We also realised that marketing would be critical to make this business work.

The Mpumalanga Economic Growth Agency has funding available to develop the market and to assist in unlocking the government supply chain so that the cooperative can also sell its water to government departments,” says Msonza.

The CSIR also assisted the cooperative to upgrade the equipment at the factory.





(Left) Vivian Radebe, a CSIR enterprise development practitioner and Thobile Nkosi, a supervisor at the Donkerhoek Water Bottling factory at the plant's water purification infrastructure. (Above) Outside facilities at the water bottling plant in rural Mpumalanga and the plant inside.

"This included the commissioning and installation of new equipment. We needed to replace and repair non-functional equipment and install a filtration system. The CSIR is overseeing the establishment of a water testing laboratory at the factory so that on-site water testing can be done."

The next steps include piloting the plant and scaling up to full production towards the end of 2017.

"The aim is to hand over a fully operational factory. We are also upskilling the cooperative and helping them to employ skilled managers and workers for the business. The cooperative has indicated that they would like the CSIR to help with implementation into 2018," says Msonza.

Thobile Nkosi, a supervisor at the Donkerhoek plant, says that the CSIR has helped the business tremendously by providing information and technical support that they did not have before. "This plant will create job opportunities for my community. I am happy that everything I do here is for the future of me and my people."

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Revitalising sisal cultivation to boost community in North West

The CSIR is supporting the North West Provincial Government to revitalise a sisal farm in the province to boost local economic development. Sisal, which can be used to make ropes and fibre-based composites, is a water-wise crop that is easy to cultivate in arid regions. The intention is to also enable farmers who cultivate sisal on a small-scale, to supply to a factory based on the farm.

The use of natural and renewable resources, such as sisal fibre, in manufacturing has become more wide-spread due to a global heightened concern for the environment.

The North West Department of Economy and Enterprise Development commissioned the CSIR to undertake a comprehensive feasibility study that evaluated the market, technical, economic and financial aspects of the Madikwe sisal project on the Tolane farm north-west of Rustenburg.

“Sisal is a drought-resistant crop that grows in areas where few other commercial crops survive,” says the CSIR’s Brighton Msonza, who leads this project. Msonza is part of a team of CSIR experts with experience in enterprise development and agro-processing projects.

“Historically, sisal fibre was used to produce ropes, twines and products such as bags and carpets, but more recently, to make geo-textiles, speciality paper and fibre-based composites for the automotive, aerospace and built environment sectors.”

Global sisal farming, which declined when synthetic fibres came onto the market, has settled at 250 000 tons per year during the past decades. In South Africa, almost all of the local sisal needs are addressed through imports.

“Local businesses that import their stock have indicated that they are willing to

buy locally produced sisal fibre and 10 tons of Madikwe’s existing stock were sold to a company in Polokwane that makes carpets and twine,” says Msonza.

A total of 100 ha of sisal has been planted at Madikwe to date, but the farm needs to expand cultivation to at least 600 ha to make the enterprise financially viable.

“The CSIR is implementing the project in phases and plans to plant another 100 ha with the next round of funding. The project employs eight people at the factory site. A system of outgrowers was also proposed by the CSIR, in which families and groups of people can establish small business initiatives, growing sisal on their land and selling the plants to the factory,” says Msonza.

“ THIS PROJECT WILL MEAN A LOT TO THE COMMUNITY. IT ENABLES ME TO PROVIDE FOR MY FAMILY. ”

Michael Molenke
Farm worker



Michael Molenke (top), a worker on the Tolane farm north-west of Rustenburg, holds fibre produced on-site from sisal plants (left).

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CSIR
support
for jobs
in waste



The CSIR has undertaken research for the Green Fund to evaluate waste and recycling cooperatives in order to understand the opportunities and constraints facing waste cooperative implementation in South Africa. The Fund is managed by the Development Bank of Southern Africa on behalf of the Department of Environmental Affairs. The waste sector can contribute towards addressing South Africa's unemployment challenges.



Approximately 80-90% of all post-consumer paper and packaging recyclables in the country are collected by informal waste pickers.

The informal waste sector in South Africa has been active for more than two decades and plays an important role in diverting recyclables away from landfills. However, CSIR research shows that the sector is marginalised and operates at the fringe of municipal solid waste management systems. In efforts to create sustainable, thriving cooperatives, the public and private sectors need to collaborate to boost cooperative development in the waste sector.

"We have all seen the trolley pushers on our roads," says CSIR principal researcher, Dr Linda Godfrey, referring to the informal waste pickers collecting waste from kerbsides. "There are an estimated 60 000 – 90 000 informal waste pickers earning a livelihood from the collection and sorting of recyclables in South Africa. Working on landfill sites and at kerbsides, these informal waste pickers collect approximately 80 – 90% of all post-consumer paper and packaging recyclables in the country, saving municipalities R750 million in landfill airspace per annum, at little to no cost."

One of the ways to integrate the informal waste sector into the formal waste economy is to formalise the establishment of cooperatives, explains Godfrey. Cooperatives are jointly-owned enterprises operated by members for their mutual benefit. "We found that cooperatives, not only waste and recycling cooperatives, have a very high failure rate in South Africa." Waste cooperatives in the country face numerous challenges in their day-to-day duties, including the lack of infrastructure such

as transport, equipment and premises to sort and safely store their collected waste, as well as the lack of capacity for training and acquiring knowledge and skills.

She explains: "What we found is that while training is necessary, it is often insufficient. What cooperatives need to become sustainable, is incubation and mentoring, but this comes at a significant cost."

Godfrey believes that cooperatives require long-term support and investment from all relevant role-players in the sector, as they have the potential to create a significant number of direct and indirect income opportunities. Amalgamated Beverage Industries (ABI) employed this model with small, medium and micro enterprises (SMMEs) in the recycling sector, with good results in terms of profitability and productivity. Consequently, the CSIR partnered with ABI to discuss integrating the informal sector and SMMEs into municipal solid waste management in South Africa.

The CSIR provided insight into potential solutions to waste management challenges in South Africa. "The waste sector can support low-skilled workers and also provide wonderful opportunities to deal with waste as a secondary resource." The sector can help address South Africa's unemployment challenges through creating large numbers of low-skill jobs to address current challenges, while at the same time developing new enterprises that will require new types of skills," says Godfrey.

THE CSIR PROVIDED INSIGHT ON POTENTIAL SOLUTIONS TO WASTE MANAGEMENT CHALLENGES IN SOUTH AFRICA.

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A guide for essential oils producers

The CSIR has developed an agronomic and processing guide for small-scale entrepreneurs interested in the essential oils industry.

Essential oils are highly valuable products that are used globally in the pharmaceuticals, fragrance, flavour, aromatherapy and cosmetology industries. The global essential oil market size exceeded US \$6 billion in 2015. South Africa is well-positioned to contribute to this sector as the country is richly blessed with fertile land, a diverse climate, resources, basic infrastructure and a strong tradition in agriculture. The South African industry is relatively small and interested small-scale entrepreneurs have insufficient access to relevant knowledge. The successful development of this sector will provide a diverse agricultural opportunity to numerous small-scale farmers who could benefit economically by supplying to local and international markets.

Essential oils are extracted from the leaves, stems and flowers of aromatic plants by using steam distillation. Popular oils, such as lavender, tea tree, eucalyptus and citrus are traded worldwide and used as fragrance ingredients in many household products.

In 2010, the CSIR received funding from the Department of Science and Technology to develop a new range of essential oils to diversify and expand the South African essential oil sector. In the past four years, CSIR researchers have tested approximately 20 crop varieties. Their goal was to select the crops that would be suitable to the South African climate, have a demand in the market place and provide training to emerging essential oil farmers and entrepreneurs.

Two sites were established, one in Brits (North West) and the other in Ficksburg (Free State), for conducting the agronomic experiments to determine which crops would be commercially viable in stimulating the essential oil sector in South Africa. In Brits, yarrow, marjoram, lemon balm and *Lippia javanica* were deemed the most promising crops based on agro-potential and marketing information. In Ficksburg, *Rosa damascena* of Bulgarian origin was piloted to determine the agro-potential of rose oil for the fragrance industry in South Africa and abroad.

The information gathered at the Brits site led to the development of an agronomic and processing guide for emerging essential oil farmers and entrepreneurs. This guide encompasses information on soil types, agricultural methods, processing, income potential and marketing.

CSIR senior researcher Ebrahim Wadiwala says that the aim of the guide is to empower emerging farmers and entrepreneurs with the necessary information to ease their entry into the essential oil industry.

In recent developments, the Department of Rural Development and Land Reform provided funding to a community-based cooperative in Driekop (Limpopo) to establish a small-scale essential oil business based on the cultivation of rose geranium and *Lippia javanica* crops. The Driekop project is enabled by the knowledge and experience gained through the pilot studies at Brits and other essential oil projects undertaken by the CSIR. Also see pages 30 and 31.



Ebrahim Wadiwala introduces the agronomic and processing conditions of essential oil crops to emerging farmers at a workshop in Brits.

THE AIM OF THE AGRONOMIC AND PROCESSING GUIDE IS TO EMPOWER EMERGING FARMERS AND ENTREPRENEURS WITH THE NECESSARY INFORMATION TO EASE THEIR ENTRY INTO THE ESSENTIAL OIL INDUSTRY.

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Essential oils are extracted from aromatic plants.

(Above) Samples and products from some of the crop varieties produced at different sites in South Africa.

(Right) Essential oil produced by the Temothuo cooperative in Driekop in Limpopo.

Cultivating crops for essential oil distillation

– supporting a Limpopo-based enterprise



10

PERMANENT EMPLOYEES AT THE FARM AT DRIEKOP AND MANY MORE PEOPLE FROM THE LOCAL COMMUNITY ARE EMPLOYED DURING HARVEST AND PEAK WEEDING TIMES.

(Above) The CSIR's Dr Luke Mehlo and Oupa Mphogo inspecting the seeds of the *Lippia javanica* plant.

(Adjacent page) Oupa Mphogo and Kgalalele Sekgetho, an intern of the Department of Rural Development and Land Reform. Rose geranium is one of two plants cultivated by the Temothuo Cooperative at Driekop in Limpopo.

The CSIR is helping a community in Limpopo to establish an essential oil production facility to exploit the natural properties of indigenous plants such as the lemon bush (*Lippia javanica*) and rose geranium (*Pelargonium graveolens*). The cooperative has started to harvest and distil crops, which is to be sold to manufacturers of natural aromatic and therapeutic products.

In Africa, exploiting the aromatic properties of indigenous plants through burning or distillation techniques goes back centuries, but the quantity of material that can be harvested from the wild is limited. This has led to a demand for oils from cultivated plants that manufacturers use to make perfumes, cosmetics, aromatherapeutic products and natural remedies.

The Temothuo cooperative in Driekop in Limpopo's Sekhukhune district is establishing an agro-processing enterprise that aims to produce essential oils for these manufacturers. They approached the Department of Rural Development and Land Reform, which in turn contracted the CSIR as an implementation agent for the project.

"The CSIR completed a feasibility study for the enterprise based on the potential of the 9 ha site. For example, we looked at the soil and climate, the market potential, the likely oil yield at that scale and the equipment and resources needed to establish a distillation plant at Driekop," says Ebrahim Wadiwala, who specialises in enterprise creation for development at the CSIR.

"The study included future projections, investment requirements and what the return on investment would be with the aim to hand over a fully operational business at the end of the project."

The second phase of the project included the establishment and monitoring of the crops and irrigation system, the construction of a nursery and the training and mentoring of community farmers.

"We have commissioned the distillation equipment and are already harvesting and distilling *Lippia javanica*. The CSIR will support Temothuo with chemical analysis of the oils and has introduced the cooperative to potential buyers."

The cooperative is also supported with applications for regulatory approvals such as an integrated biotrade and bioprospecting permit and a water-use licence.

Oupa Mphogo, one of the directors of the Temothuo cooperative, says the farm at Driekop has 10 permanent employees and employs many more people from the local community during harvest and peak weeding times.

"The scientific knowledge that the CSIR has brought to the farm is very valuable. The CSIR's Dr Luke Mehlo has helped us to find the correct plant species with the optimal oil yield. We also have the correct distilling equipment and farming processes in place."

Mehlo, a senior enterprise development specialist at the CSIR, says rose geranium is a popular ingredient in perfumes and soaps while lemon bush has excellent mosquito repellent qualities and can be used to make candles and other mosquito repellent products. The cooperative wishes to develop a further 100 ha to increase production volumes of essential oils in a next phase. This would see the cooperative employing a further 100 members of the community.

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enterprise creation



Lutendo Matumba assesses produce at his school farm.



A project nursery provides quality seedlings.



Nkhangweleni Phosiwa uses information and communication technologies for more effective farming.

Creating the next generation of small-scale farmers with business savvy

The CSIR implemented an educational rural development programme that teaches learners and the community how to run a successful farming business. The final phase of the research was funded by the Department of Trade and Industry's Employment Creation Fund.

The Technology for Rural Innovation and Economic Development programme was created to enable agri-entrepreneurship at high schools in order to introduce black rural learners to the farming industry. Through curriculum support, courses, mentorship and an agricultural incubator, potential farmers acquire the skills needed to run a commercially viable farm.

The programme was first introduced in Cofimvaba, in the Chris Hani district in the Eastern Cape. CSIR senior researcher, Rensie van Rensburg, says, "We designed a systemic solution rather than simply applying technology to the problem and we looked at how we can intervene in the school system in such a way that it positively affects the agricultural system around it."

As a result, the programme also gave community members, who wanted to be part of the farming business, the opportunity to participate. What came about was a solution that provided an indication of how farming can be a sustainable option to alleviate poverty in that area.

After successfully implementing the programme in the Eastern Cape, researchers identified Limpopo's Vhembe district as the next place to implement the programme. Tshikaponi High School proved to be a good fit as the school already offered Agricultural Management Practice as part of its curriculum and it was in need of space to show learners the potential of farming in a real-life scenario.

The CSIR, along with various stakeholders, works with the community and the school to demonstrate the importance of

approaching farming as a science and a business. Former students from the high school also applied to take part in the programme.

CSIR consultant, Braam Cronjé, says, "There are many young people who don't have access to land and even with access to land, do not know how to make a profit from farming. Agri-business for learners is an agricultural course that teaches the business side of agriculture."

“Ultimately, the CSIR hopes that this model will be applied throughout the country and that it will serve as a bridge from the school system into the agricultural system. We believe that it will help the next generation of young small-scale farmers start well for the future. Rensie van Rensburg – CSIR senior researcher”

Since the implementation of the project, the school has been able to supply maize and other produce to the local markets and has created farming-related jobs for community members who partake in the course. Participants have been mentored on managing the finances of a farm and have been encouraged to start their own farming businesses or become business advisors for small-scale farmers.

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Coaching community members on the safe use of pesticides.



Elias Matumba, agricultural management practice teacher at the Tshikaponi High School providing guidance to the next generation of small-scale farmers, Lutendo Matumba and Nyandano RaMulongo.



Tea plantations at Tshivhase Tea Estate.

Diversifying the product range of the Tshivhase Tea Estate

The CSIR is using science and technology solutions to help the Tshivhase Tea Estate stay in business and improve its competitiveness by diversifying the estate's range of products.

Many small to medium enterprises look for funding and assistance from government departments to maintain or grow their businesses. These departments, including the Departments of Science and Technology (DST) and Agriculture, often request the CSIR to help beneficiaries of these funds to stay relevant in their various industries. CSIR specialists look at enterprise creation and development by conducting feasibility studies, identifying possible opportunities for diversification and developing programmes that can support the business.

CSIR senior enterprise development specialist, Bernadette Brown, says, "Our strength is in developing an enterprise from scratch. We start with a feasibility study that could lead to the

development of a business plan, we secure public funding, help with the legal process of registering the business, set up factories, assist with staff appointments to resource the enterprise and conduct skills and technology transfer programmes for the chosen projects."

DIVERSIFYING THE PRODUCTS AT TSHIVHASE TEA ESTATE

When Tshivhase Tea Estate needed to diversify its offering, the Limpopo Department of Agriculture approached the CSIR to help conduct a pre-feasibility study. During this process, CSIR researchers looked at market, technical, economic and financial aspects. The estate produces and sells black tea and has an estimated 2 000 staff at its facility, however, the estate's business model was not sustainable. The CSIR was tasked with





(Left) James Bokosi of the Tshivhase Tea Estate and Vivian Radebe (back) of the CSIR conducting production tests in the pilot facility.
(Above) *Camellia sinensis* leaves.

creating value-added products based on tea crops cultivated from *Camellia sinensis* and packaged black tea products. For this, experts looked at the viability of botanical extracts as an additional product line.

To assess whether or not botanical extracts could be commercially viable, the CSIR proposed an in-depth feasibility study, including the establishment of a pilot production facility. As the funding requirement for this work was high, the CSIR approached the DST to provide the necessary co-funding to cover the shortfall of funds. Brown says a pilot study is typically done to test technical viability and gather accurate production data to complete the comprehensive feasibility study. The final stage was the undertaking of a comprehensive feasibility study leading to the drafting of a business plan that could be sent to potential funders.

Stakeholders of the estate say that they have learnt a lot from their interaction with the CSIR. They are impressed with the extent of resources and expertise that were used to address their need to diversify their product lines. They are confident in their improved skills and keen to implement the next phase that their business is venturing into.

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enterprise creation

THE TSHWANE BUSINESS PROCESS OUTSOURCING PARK IS POISED TO BECOME A CENTRE OF EXCELLENCE FOR BUSINESS PROCESS OUTSOURCING IN SOUTH AFRICA, PROVIDING A ONE-STOP SHOP APPROACH TO ALL BUSINESS PROCESS OUTSOURCING NEEDS.



Supporting the creation of substantive township economic activity

The CSIR is helping the City of Tshwane realise its vision of stimulating economic township development through the establishment of the Tshwane Business Process Outsourcing Park (BPO) in Hammanskraal, outside the economic hub of Pretoria.

Small, medium and micro enterprises (SMMEs) will be able to supply products and services associated with the construction phase of the Park. Once construction has been completed, these enterprises will also have access to an on-site incubator and training centre.

In 2011, CSIR researchers conducted a pre-feasibility study to determine if the concept of a BPO Park is feasible in Hammanskraal. CSIR researcher Loyiso Nxumalo says, "This is a novel approach, where a BPO Park is built outside the central business district with the aim of creating substantive economic activity in the township."

After having developed a detailed business plan for the BPO Park, the CSIR was contracted to support the City of Tshwane during the implementation of the Tshwane BPO Park Phase 1, which includes the construction of two purpose-designed buildings to house BPO operations, complete with IT infrastructure, thereby providing an attractive plug and play environment for tenants.

The implementation work includes the appointment of a professional team to supervise construction, as well as an IT designer and project manager. Construction of the BPO Park, estimated to cost in excess of R300 million, began in 2016 and will create an envisaged 1 950 temporary job opportunities. The BPO Park will also have other support infrastructure including a

crèche, playroom, clinic, swimming pool and sports grounds. The completed phase 1 of the BPO Park will employ 1 100 full-time BPO staff.

The concept of business process outsourcing came about in the early 90s when companies started outsourcing their non-core operations and specific business processes to third-party service providers with a view of reducing costs while increasing quality. BPO was the only sector that showed continued growth through and after the recession in 2008 and its resilience in tough economic times appealed to the city's quest to develop the township economy.

The park will also provide opportunities for SMMEs to participate in support operations such as IT support, catering, cleaning, security, landscaping, staff care and other support services.

In addition to the main facility where the core BPO business activities will be undertaken, an in-house incubator and training centre will assist local entrepreneurs and SMMEs to develop their businesses to the point where they could compete with larger established park tenants.



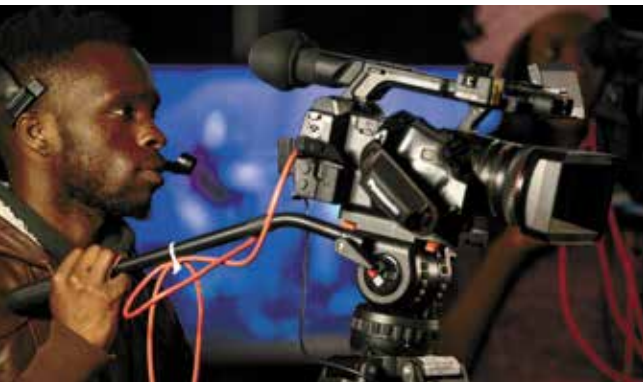
Construction of the Tshwane Business Process Outsourcing Park started in 2016.

(Right) CSIR Enterprise Development Portfolio Manager, Loyiso Nxumalo (left), on site with Solly Shivambu, Fikile Construction Project Manager.



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CSIR technology stimulating the media and broadcast industry



CSIR researcher Moipone Ramokone and Bigfish student Alfred Seabi.

The CSIR has developed a technology that allows for the streaming of mobile videos without buffering. The technology makes it possible for entrepreneurs to operate their own Internet-based television stations over mobile networks. The technology has been licensed to three small, medium and micro enterprises.

The CSIR's mobile Internet protocol television platform has the potential to stimulate growth within commercial media organisations and enable new opportunities for micro-enterprises and micro-workers in the media sector to specifically target mobile viewers.

The platform is made up of two main components. The first is the Micro-enterprise media engine – broadcast (MEME-B), which addresses bandwidth constraints using novel compression algorithms. This solution compresses streams of data to match available bandwidth so that the viewer does not experience buffering, thereby ensuring that content reaches audiences effectively and efficiently without the need to make changes to hardware and infrastructure. The second component, Micro-Enterprise Media Engine – Workflow (MEME-W), addresses station management. It enables a broadcast manager to commission work from other media professionals and upload, schedule and broadcast to audiences, while also connecting audiences to advertisers.



CSIR technology has been integrated into the curriculum of local film school, Bigfish School of Digital Filmmaking. CSIR researcher Thabang Sono and Bigfish student Phelisa Mgulwa testing aspects of the technology.

The technology has been licensed to three small, medium and micro enterprises (SMMEs) namely, Psybergate, Skyrink and Embizo. To address youth unemployment, the technology has also been integrated into the curriculum of a local film school, Bigfish School of Digital Filmmaking, with the intention of incorporating it into the curriculum so that students become familiar with it before they graduate. "This will help in sourcing micro-workers and promoting entrepreneurship by providing production opportunities through sponsored calls for content," says Dr Keith Ferguson, CSIR research group leader for media and networks.

The platform was developed in an effort to disrupt the traditional value-chain of the commercial television industry, which is dominated by large regional monopolies that own high-cost delivery platforms and act as the only gateway for content. "The audiences are typically regionally bound and are not global. To reach their desired

audiences, local television programme producers are forced to sell to these few organisations with high-risk costs and high-rejection rates for small and micro enterprises," says Ferguson.

The technology brings media producers and their global audiences into direct contact and in so-doing, widens the scope for participation by micro enterprises and individuals as micro-workers. "The platform enables open access where the global delivery platform becomes a service to television producers and not a stranglehold," says Ferguson. He says that it is helping to promote diversification in the South African media industry and broaden the participation of currently excluded skills.

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SO FAR, THE PLATFORM HAS RESULTED IN THE EMPLOYMENT OF FOUR FILM STUDENTS, FOUR FULL-TIME MEDIA EMPLOYEES, SEVEN FULL-TIME TECHNOLOGY EMPLOYEES AND APPROXIMATELY 25 WORKERS ACROSS THE THREE SMMEs.



CSIR technology used in eco-friendly products manufactured by spin-out company

In recent years, bacteria from the genus *Bacillus* have shown promise for a number of industrial applications because they secrete enzymes that break down pollutants like ammonia, nitrates, phosphates, as well as organic pollutants. These bacteria can also survive as spores for long periods of time, break down solid waste material and reduce odours.

The CSIR has spent over 10 years building a library of naturally-occurring, South African *Bacillus* strains with potential commercial value.

Approximately three years ago, then CSIR chief researcher Dr Raj Lalloo saw an opportunity to use this growing biological library for the good of all South Africans. "There was an increasing market interest in tangible products," says Lalloo. "The CSIR decided to create a spin-out company to give the opportunity the focused attention it required."

With support from the CSIR and its commercialisation team, access to the Biomanufacturing Industry Development Centre (BIDC) and with advice from CSIR Entrepreneur in Residence, Richard Fearon, Lalloo took the plunge.

Officially launched in September 2014, with Lalloo as Chief Technical Officer, OptimusBio develops eco-friendly biological products for sanitation, water treatment, aquaculture and agriculture, using these indigenous bacteria.

OptimusBio uses technology developed at the BIDC for product manufacturing.

"The technology is based on the concept of biomimicry – the design and production of materials, structures and systems that are modelled on biological processes. In this case, good bacteria are used as nature's 'machines' to clean wastes. Our indigenous bacteria integrate into natural ecosystems through the principle of bio-augmentation. The products were developed with the aim of replacing the harsh chemicals and pollutants with next-generation biological and biodegradable alternatives, to improve well-being, while preserving scarce water and environmental



Technologically advanced eco-friendly and biological products.

resources,” explains Lalloo. “This is technology, developed over many years, with significant potential impact, and we are excited about how it will change the landscape towards a more sustainable planet. Earth probiotic, another solution under investigation, also uses a special bacterial mixture developed by the CSIR to convert solid food-waste to compost.”

The CSIR’s propriety technology has been tested to liquefy and degrade solid waste material, industrial and domestic effluents, reduce odour and reduce the prevalence of disease-causing pathogens, says CSIR researcher Ghaneshree Moodley, who works on the core technology.

“Core components of the technology include biological screening and selection, applications testing, high-density bacterial fermentation, downstream processing and formulation that yield highly engineered products. The products contain microbial enzymes produced in a self-regulating system, mixed with biodegradable surfactants and they mimic the look and feel of conventional products. The technology helps to start the waste treatment process at its source. It reduces the burden on waste management, improves the well-being of people and preserves the environment,” says Moodley.

Demonstrating its support of green living and local innovation, the CSIR has successfully implemented the use of OptimusBio eco-friendly biological cleaning products across most of its campuses.

Katherine Kirkbride, Manager: Shared Services Operations at the CSIR says that the feedback from Quatro Cleaning Services staff members who have been using the products since September 2016 has been positive.

“Some of our cleaning staff have already indicated that the eco-friendly products are not harsh on their hands and they appreciate not being exposed to chemical odours while they work,” she says. “The CSIR has to maintain its facilities, but the organisation also has a responsibility to protect the environment for future generations and provide a healthy workplace for its employees. By using the eco-friendly products, the CSIR also demonstrates its trust in its own research output,” says Kirkbride.

The CSIR has also supported the South African National Defence Force to test the OptimusBio products for personal care, cleaning, as well as water and waste treatment during remote deployments in the Kruger National Park.

According to Fearon, the creation of a commercially sustainable South African bio-industry is an essential cornerstone of Africa’s future. “OptimusBio has the potential to contribute to projects that could positively impact global standards of living. These include issues such as water sustainability, health and food security, all of which contribute to human kind and its well-being,” he says.



OPTIMUSBIO
GREENER TOGETHER

OptimusBio, a CSIR spin-out company, manufactures biological products that contain active, beneficial bacteria from the genus *Bacillus*. The CSIR has been developing *Bacillus*-containing products for a number of years and has built up a database of *Bacillus* organisms, as well as knowledge on the production and formulation of the bacteria.

OptimusBio is a small enterprise operating from the CSIR premises and is incubated as part of the Biomanufacturing Industry Development Centre.

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Joining forces with an SMME for cutting-edge technology to safeguard miners

The CSIR and Johannesburg-based small, medium and micro enterprise, Hannover Engineering, have been collaborating for many years to develop and manufacture products that improve safety during mine rescues. The latest invention is a training device that helps miners adjust to the unusual and uncomfortable physical sensations experienced when breathing from a body-worn chemical-based breathing device during emergencies.

On 16 September 1986, 177 mineworkers died in one of South Africa's worst mine disasters, an underground fire that released deadly toxic fumes. After this tragedy, portable, self-contained self-rescuers were deployed in mines.

These belt-worn devices supply mineworkers with life-saving oxygen during emergencies such as fires, when a toxic atmosphere develops, thereby enabling them to escape. Since 1997, the CSIR joined forces with Hannover Engineering (Pty) Ltd to develop several patented products and parts to improve the efficacy of this equipment. While the CSIR owns the patent, Hannover Engineering is recognised as the

co-inventor and shares in royalties earned from the sale of patented technology.

"This year marks 20 years of our collaboration to support the mining industry. Our latest product is an expectation trainer that miners can use during self-contained self-rescuer training to get used to the sensation of breathing through a self-contained self-rescuer," says CSIR mining initiatives business manager, Riaan Bergh.

"When underground mine workers breathe into self-contained self-rescuers during an escape from an irrespirable atmosphere, the chemicals inside the unit provide oxygen and remove the exhaled carbon dioxide. It produces heat as a by-product. Users may become anxious

when they breathe in the hot air and experience an increase in breathing resistance. This could lead them to panic and possibly remove the equipment, with fatal consequences. Therefore, intensive training is needed for the wearer to become accustomed to such abnormal breathing sensations," says Hartmut Abert, managing director of Hannover Engineering.

The expectation trainer is designed to be reusable and consists of a mouthpiece, nose clip, a plastic body and a heat retention unit. It allows the user to experience the sensation of breathing in a real self-rescuer for up to five minutes. During this time, the inhalation temperature will be between



Shadrack Moyo of Hannover Engineering confirming the dimensions of rubber extrusions.



Rubber suction pads for the nose clips shortly after having been removed from the manufacturing mould.

40°C and 60°C and breathing resistance at approximately 1 000 Pascal. These conditions are typical during an escape scenario. The user will experience dryness in his mouth and throat due to the heating and drying effect, as well as elevated breathing resistance levels.

The CSIR and Hannover are in the process of negotiating a license agreement and this device will be presented to industry in the near future.

“We also co-developed a mouthpiece that is adapted for use with self-contained self-rescuers. It is manufactured by Hannover and Specialised Mouldings, in both cases under license from the CSIR,” says Bergh.

“The mouthpiece prevents the over-stimulation of the sublingual saliva glands in the mouth and is already used in the majority of self-contained self-rescuers deployed in South African mines.”

According to Abert, the developers researched the cause of saliva build-up inside breathing tubes of self-contained self-rescuers while using previous

“WE ARE SPECIALISTS IN RUBBER PRODUCT TECHNOLOGY AND ENGINEERING AND ARE ABLE TO ADVISE THE CSIR ON WHAT IS FEASIBLE TO MANUFACTURE, WHILE THE CSIR UNDERSTANDS THE NEEDS OF THE MINING SECTOR AND HAS STRONG CAPABILITIES IN SCIENTIFIC RESEARCH AND DEVELOPMENT, AS WELL AS PATENT REGISTRATION.”

Hartmut Abert
MD: Hannover Engineering

generations of mouthpieces and came to the conclusion that small design modifications can prevent an excessive saliva build-up due to less pressure on the sublingual saliva glands.

Hannover also manufactures a special gas seal, which is critical to the long-term stability of the rescue units, as well as a special protective sleeve used inside the chemical canister to limit powderisation of the chemicals.

Hannover and the CSIR also developed a mouthpiece that integrates a breathing tube that fits more compactly in the limited space of new-generation compact light-weight models.

A noseclip, which consists of two rubber spring-loaded suction pads and prevents the user from breathing through the nose while using the device, was developed and patented by the CSIR and is manufactured under licence by Hannover Engineering.

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(Above) CSIR laboratory manager for self-contained self-rescuers, Michael Sehlabana (middle) demonstrates the components of an expectation trainer to CSIR business area manager for mining initiatives, Riaan Bergh (left) and Hannover managing director, Hartmut Abert.

(Left) An expectation trainer heat retention unit is being machined at the manufacturing facility at Hannover Engineering.

Going green saves SMMEs money

Issues of resource efficiency and cleaner production do not often top the agenda of small, medium and micro enterprises. Instead, these enterprises are often consumed by short-term pressures to remain profitable and pay overheads. The European Union-funded, SWITCH Africa Green project, offers these enterprises an opportunity to improve their bottom line while building a sustainable business that is moving the country to a low-carbon economy.



Biofuels is one of 20 companies that attended the SWITCH Africa Green workshop in Limpopo this year. This incubator provides an illustrative platform on the manufacture of biofuels for small and medium enterprises. By collaborating with the National Cleaner Production Centre South Africa, Biofuels introduced a number of companies to the SWITCH Africa Green Project. The next step in the journey for Biofuels is to undergo an assessment that will help the incubator determine where it can save costs and also identify other synergies.

Paul Matsunyane, business development officer and chemical technician at Biofuels, demonstrates the quality of biofuel produced at the biofuel plant. He is helped by plant assistant Martins Tlaka (top and right).





The SWITCH Africa Green project equips small, medium and micro enterprises (SMMEs) with the skills and knowledge to apply resource efficiency and cleaner production methodologies systematically and in an integrated approach to the industrial processes and functions of companies.

Victor Manavhela, Gauteng Regional Manager of the National Cleaner Production Centre South Africa (NCPC-SA), says that this contributes to a reduction in the amount of waste and environmental pollution produced and that companies can then generate additional revenue by saving resources.

Manavhela says, "We do not offer SMMEs money to fund their activities, but instead allocate skilled resources that can identify where money can be saved within the company. In doing so, we help form profitable, sustainable businesses that create jobs and reduce poverty."

Other benefits SMMEs reap from SWITCH Africa Green include keeping track of materials; identifying, quantifying and analysing all significant materials inputs and outputs in business systems; enabling the reuse and reduction of virgin materials and informing policymakers on policy reforms.

The project is implemented by the United Nations Environmental Programme in six pilot countries, namely Burkino Faso, Ghana, Kenya, Mauritius, South Africa and Uganda. Project partners include United Nations agencies, notably the United Nations Development Programme and the United Nations Office for Project Services, the African

Union Commission, the African Roundtable on Sustainable Consumption and Production and the African Development Bank.

Each country has a selected focus area. In South Africa, the project is implemented by the NCPC-SA in collaboration with the Department of Environmental Affairs for strategic leadership and coordination of the project.

The NCPC-SA uses industrial symbiosis as the vehicle to implement SWITCH Africa Green. Industrial symbiosis is an association between two or more industrial facilities or companies in which the wastes or byproducts of one become the raw materials for another. "We capacitate SMMEs to form synergies in manufacturing, industry and agriculture. In every production process, there will be waste, hence the need to implement industrial symbiosis, where the waste or byproduct of one company can be reused and recycled in the production process of another company."

Through the NCPC-SA Industrial Symbiosis Project, AJ Polycycling and Lancet Laboratories diverted 20 tonnes of waste from landfill with a combined saving of R263 800. "AJ Polycycling also formed a partnership with Enviroserv Waste Management and together diverted 150 tonnes of waste from landfill and saved R172 800 in virgin material," says Manavhela.

The NCPC-SA is a programme of the Department of Trade and Industry hosted by the CSIR.

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SMMEs that would like to find out more on how to participate in either SWITCH Africa Green or in the Industrial Symbiosis Project can send an email to: ncpc@csir.co.za or visit: www.ncpc.co.za



enterprise and supplier development

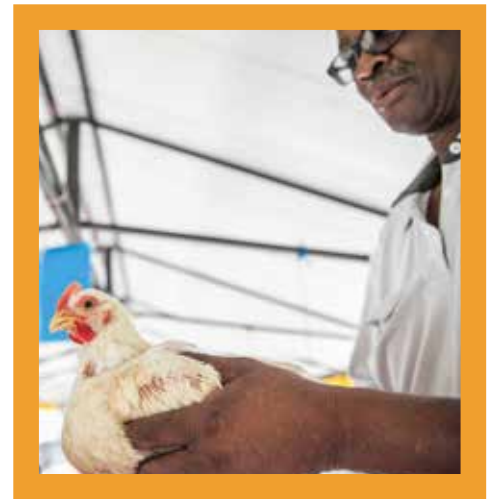


CSIR environmental assessment practitioner Rirhandzu Marivate in conversation with small-scale business owner, Edward Teffu, at his chicken broiler facility in Onderstepoort, outside of Pretoria.



The CSIR helps small business owners meet the necessary environmental regulations when growing their businesses by rendering support to the Special Needs and Skills Development Programme of the Department of Environmental Affairs.

Helping entrepreneurs meet environmental obligations



Small-scale businesses in the agricultural or mining sector are potentially lucrative. The growth prospects in both sectors have the potential to provide a sustainable revenue stream for entrepreneurs. However, many of these opportunities are linked to complying with environmental regulations, which often require environmental impact assessments (EIAs). An EIA is a report that shows what consequences one's project will have on the natural surroundings, such as the water, air quality and land. The cost of these assessments contributes to unequal economic opportunities. In addition, a lack of knowledge on these aspects limits entrepreneurs from exploring these avenues.

SPECIAL NEEDS AND DEVELOPMENT PROGRAMME

Guided by the National Environmental Management Act, the CSIR put in place guidelines on how the Special Needs and Development programme would operate. The programme addresses two issues, namely challenges around the knowledge required and the affordability of EIA plans for growing businesses, as well as the need to groom new experts in this field. The programme carries the costs of EIAs for eligible candidates. Candidates have to submit their business plan, proof of financial support and how they currently use water and waste in their projects.

EXPANSION OF A POULTRY BUSINESS

Edward Teffu runs a poultry business where he buys, rears and sells chickens. He started small, with only 500 chickens in 2008. Today, he rears more than 1 500 chickens every six weeks at his broiler facility, located in Onderstepoort,

outside of Pretoria. Like many budding entrepreneurs, he wanted to expand his business by rearing more chickens and adding an abattoir to his facility. For him to do this, he needed funding to clear the land and undertake the necessary construction. In approaching the Land Bank for funding, he was asked to submit the necessary EIA reports to begin the next phase of his business.

The CSIR was able to assist him through the organisation's involvement with the Special Needs and Development Programme. "The CSIR helped me to go through all the departments involved, making sure that my business meets the environmental regulations. On my own, I would have long given up."

Junior environmental assessment practitioners, Rirhandzu Marivate and Kelly Stroebel of the CSIR were instrumental in Mr Teffu's case. They assisted him in identifying and contracting experts in geology, water, ecology and heritage. The researchers also assisted with the completion of paperwork to receive the necessary permits to open an abattoir and to compile the reports and findings from the experts. These reports were submitted to the various government departments to show compliance with the environmental regulations.

Stroebel says the programme is helping to close the gap for entrepreneurs who wish to grow their businesses, but find themselves in unfamiliar regulatory territory that requires the involvement of independent contractors and experts to conduct costly procedures.

TO DATE, THE CSIR HAS RECEIVED 30 APPLICATIONS AND COMPLETED APPROXIMATELY 15 ENVIRONMENTAL ASSESSMENT REPORTS. MOST OF THE BENEFICIARIES HAVE BEEN IN AGRICULTURE, MINING AND TOURISM.

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Developing local suppliers for the aerospace industry

In pursuing its mission of enhancing the global competitiveness of the South African aerospace and defence industry, 12 projects of the Aerospace Industry Support Initiative, in the 2016/2017 financial year, benefited 23 organisations of which 15 are small, medium and micro enterprises.



The two brackets (right) were developed by Daliff for an Airbus A400M wing to fuselage fairing assembly.

The main objective of the Aerospace Industry Support Initiative (AISI) is to assist the aerospace and defence industry to improve its competitiveness, productivity and quality management systems and in doing so, optimise its operations to ensure the integration of South African industry into global supply chains. Technology and skills transfer, as well as supplier development incentive schemes, enable participation in the economic sector, which, without intervention, would not have been possible for sub-tier small, medium and micro enterprises (SMMEs).

Supplier development is a key focus to ensure industry transformation and the broadening of economic participation in the industry. Technology and skills transfer, as well as supplier development are the two pillars anchoring the supplier development programme.

“This programme enables the inclusion and integration of suppliers who would otherwise not be able to participate in the industry. It is about developing the sub-tier SMME manufacturing base for higher tier companies that supply components to original equipment manufacturers,” says the CSIR’s Marié Botha, AISI key account manager.

Four SMMEs that benefited from the AISI’s supplier development programme through assistance by state-owned aerospace and defence technology conglomerate, Denel, are Daliff Precision Engineering, Cliff’s Way Aerospace, MicroMax and T&T Engineering.

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Following a continuous improvement programme over eight years, Daliff’s improved and increased machining capability has enabled the company to supply quotations to the United Kingdom and other European Tier 1 suppliers.

MACHINED COMPONENTS FOR AEROSPACE COMPONENTS: DALIFF PRECISION ENGINEERING AND CLIFF'S WAY AEROSPACE

The AISI provided focused assistance to Daliff Precision Engineering and Cliff's Way Aerospace for the production and assembly of machined components that are produced to tight tolerances in a range of materials. These companies have a competitive range of modern computer numerical controlled precision milling and turning equipment and state-of-the-art manufacturing control software. The bulk of their work is in aerospace, mainly the production of airframe components. Both companies are approved suppliers to Airbus for the Airbus A400 military transport aircraft.

The companies went through 18 months of training and skills transfer through Aerosud Aviation and Denel Aerostructures respectively, with support from Airbus. Having completed the programme, both SMMEs can now compete globally. The biggest benefit is improved machining capability that has led to quicker turnaround times, first-time right improvement, collision prevention and faster cutting with opti-path optimisation.

ADVANCED MACHINED METALLIC PARTS: MICROMAX

MicroMax is a supplier of advanced machined metallic parts. Its core business is in the aerospace and defence industry as a manufacturer of airframe components for a number of companies within the Denel Group.

The company needed to upgrade its international accreditation from ISO 9001 to AS/EN 9100 to be able to supply Denel Aerostructures. The latter assisted MicroMax with facility assessment and recommendations, review and approval of records for inventory management, and review of material handling and management in terms of AS/EN 9120 standards.

The benefits for MicroMax included improved logistics for issuing material per order, delivery of full batch, improved stock management and improved industry compliant controls.

PRECISION COMPONENTS: T&T ENGINEERING

T&T Engineering is a precision component manufacturer. Denel Aerostructures helped the company with ISO 9001:2008 international accreditation that would allow them to supply to state-owned-enterprises such as Denel, Transnet and Eskom.

Specific interventions included: Quality improvements, industrialisation, first article inspection, tooling design, turnkey solution support, support with delivery performance schedule, as well as financial management.

The result was improved and increased control of economic batch quantity, better capacity planning and improved capability for on-time delivery. The ISO 9001 accreditation means that the company is now earmarked for an upgrade to AS/EN 9100 accreditation. The AS/EN 9100 standard is a series of standards specific to the aerospace industry to ensure quality in all parts of the supply chain.

The AISI is funded by the Department of Trade and Industry and hosted by the CSIR. The need to grow the South African economy and create sustainable jobs remains urgent and the aerospace industry, with its advanced manufacturing capability, provides an attractive opportunity. The programme has been running for over 10 years.

The AISI takes its strategic direction from government's objectives of addressing industry challenges as identified in the sector development plan and the Industrial Policy Action Plan. These challenges include:

- Limited participation of locally-owned companies in key strategic technological areas such as aerospace
- Insufficient diversification into export markets and product diversification
- A shortage of large development programmes to build technology and skills pipelines and to accelerate knowledge transfer between knowledge-generating entities and industry
- Risk of exclusion from secondary markets due to the rising aerospace and emerging market economies
- An insufficient skills pipeline and a loss of skills.

Technology transfer intervention leads to major breakthrough for local SMME

The Aerospace Industry Support Initiative, in conjunction with industry partner Denel, has played a big role in enabling the manufacturing by a local enterprise of the first new gas turbine prototype running in South Africa since the late 1980s.

One of the ways in which South Africa's Aerospace Industry Support Initiative (AISI) bolsters the global competitiveness of the country's aerospace and defence industry, is through supplier development. In this respect, the focus is on technology enhancement, enterprise enhancement, assistance with standards and accreditation and supply chain optimisation.

The lack of a local capability in propulsion systems is a shortcoming in the country's aerospace industry. The AISI led a technology enhancement intervention, specifically relating to compressor design, with local SMME, Cape Aerospace Technologies (CAT), in the development of the CAT 200 Kero Start (KS) gas turbine.

This specification is set to fill a market gap first identified in 2008. Denel Dynamics, for example, requires a small gas turbine (600 N SLS thrust) for numerous projects, also to power future unmanned aerial vehicles, target drones and glider sustainers (self-launchers), as well as offering the possibility of decentralised local power generation using biomass fuels for remote areas.

AISI key account manager, Marié Botha, says, "The AISI identified the opportunity to transfer knowledge to a start-up SMME, and in doing so, keep a national capability within a South African SMME. The AISI facilitated access for the enterprise to CSIR expertise in this field and oversaw the implementation of the project."

AISI is an initiative of the Department of Trade and Industry hosted and managed by the CSIR, with the main aim of positioning the South African aerospace and defence-related industry as a global leader, in niche areas, whilst ensuring effective interdepartmental participation and collaboration.



The CSIR's Lulekwa Makapela with the micro gas turbine engine, developed by local company Cape Aerospace Technologies.



The CAT 200 KS, a micro gas turbine engine developed by Cape Aerospace Technologies.



LOCAL MICRO-GAS TURBINE MANUFACTURING

CAT was established in 2013 to fill the void of South African aerospace companies that manufacture high-precision micro gas turbines. The lack of a propulsion systems capability in South Africa hampers the country's global participation.

The technical achievement of getting the first new gas turbine prototype running in South Africa since the late 1980s creates the basis for a future independent aeromotive capability for South Africa, says Botha. "The fastest-growing developing economies place a premium on aerospace skills sets, and South Africa should be leading in this regard," she says.

"The project is contributing to South Africa becoming a global leader in terms of state-of-the-art micro gas turbines. CAT has developed a prototype/demonstrator engine, and designed and integrated a diagonal/mixed flow compressor into the 200N engine. Further objectives included commercialising the CAT 200 KS locally and internationally and giving young engineers working on turbomachinery, exposure and training.

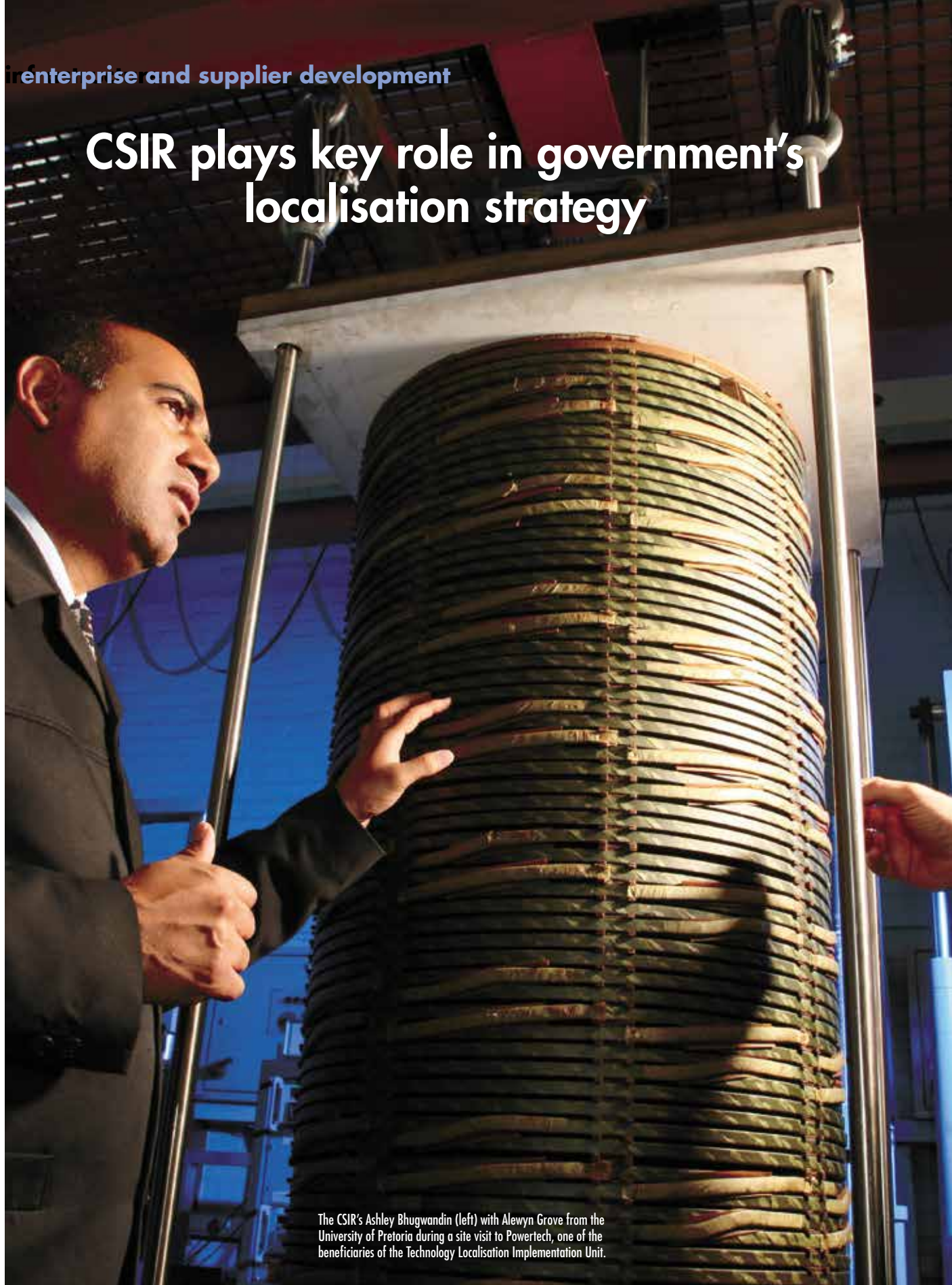
"AISI aims to add as much local manufacturing value add as possible, to ultimately broaden the economic base participating in the aerospace sector.

"This is a capability that would have been lost to the local industry were it not for the knowledge transfer. It can add greatly to the local content of South African products, which could open up large export opportunities," says Botha.

The final experimental tests on the CAT 200 KS are on-going, but results are promising.

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CSIR plays key role in government's localisation strategy



The CSIR's Ashley Bhugwandin (left) with Alewyn Grove from the University of Pretoria during a site visit to Powertech, one of the beneficiaries of the Technology Localisation Implementation Unit.



“ The Department of Science and Technology realised that technological upgrading or support is most often the key intervention required to improve the competitiveness of a firm or to enable the firm to achieve the levels of quality, time and cost required by the original equipment manufacturer or a state-owned enterprise. Therefore, the department developed the Technology Localisation Plan to support technology localisation and Technology Assistance Packages to deliver technological support. Localisation aims to increase the local industrial activity of manufacturing and services. Successful localisation is viewed as increased local content in capital programmes and operations. ”

Two South African companies, T&T Engineering, a fabrication company based in KwaZulu-Natal, and Daliff Precision Engineering, an aerospace supplier based in the Western Cape, have benefited from the technology localisation programme, an initiative of the Department of Science and Technology, hosted at the CSIR. The initiative ensures that local industry, especially small, medium and micro enterprises, benefit from massive investment programmes undertaken by government.

As part of national efforts to develop the country's infrastructure, state-owned enterprises have embarked on large capital expansion programmes. While these large programmes often procure from original equipment manufacturers based overseas, it has increasingly become global practice to link such procurement programmes to some offset commitments to use local suppliers and equipment and ensure some level of technology transfer to the recipient.

South Africa has adopted a similar approach. The Department of Science and Technology (DST) has invested millions of rands in a supplier development programme for local manufacturers, called the Technology Localisation Programme. Administered by the CSIR, the programme provides funding and technology support to enable more local firms to supply goods to state-owned enterprises. Minimum local content thresholds have been set for 16 designated inputs. Since the launch of this programme, a number of original equipment manufacturers have started buying equipment that was originally imported, locally.

Two local companies, T&T Engineering, a fabrication company based in KwaZulu-Natal, and Daliff Precision Engineering, an aerospace supplier based in the Western Cape, are benefiting from this programme.

The CSIR helped T&T Engineering with a number of solutions aimed at improving the company's competitiveness, including

the training of welders, solutions for enterprise resource planning, software design and ISO certification. Following the CSIR's assistance, the company has been recognised by Denel as having the capability and systems in place to take on aerospace-related work.

Daliff Precision Engineering is a supplier in the aerospace industry and specialises in aluminium products. The CSIR assisted the company with specialised machining software, which resulted in a 20% reduction of machining times. This has freed up capacity within the company and also improved the company's capability to take on more projects.

Both companies have also benefited from the supplier development programme of the Department of Trade and Industry, the Aerospace Industry Support Initiative. (See article on page 48).

“The success of this programme lies in seeing these companies become more competitive. We are realising our goal of increasing local production, substituting imports, improving our export capability and creating jobs. It also translates to economic development and sustainability,” says the programme manager, the CSIR's Ashley Bhugwandin.

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skills development

Nkosana Madi with his motorised bicycle. Madi started using his bicycle to commute to save money, but soon realised that he could use his passion for motorcycles to create a motorised bicycle to provide a cheaper form of transportation.



ABOUT THE TLIU

The Technology Localisation Implementation Unit is an initiative of the DST, hosted by the CSIR. It assists companies in becoming more competitive, which will increase demand for their products and services.

www.tliu.co.za

Opportunity for informal-sector innovators to turn ideas into business

The CSIR is leading a new initiative by the Department of Science and Technology to help innovators at grassroots level to commercialise their concepts and ideas.

The Grassroots Innovation Programme aims to provide innovators, irrespective of their educational background, age, race or standing in society, with a platform to excel at what they do. The end goal is to take their innovations from an idea to the next level, where it can eventually be commercialised.

Through this programme, participating individuals are linked to subject matter experts and advanced facilities where their innovations and inventions can be further developed towards a commercial model.

The term 'grassroots innovation' refers to products or processes created by innovators to solve local problems using local resources and working outside the formal mechanisms and institutions of innovations. A large percentage of South Africa's population resides in rural areas or townships. Within these communities, many innovators do not have access to structured or formal systems or expertise.

Innovators assisted through this programme benefit from a variety of skills development programmes that improve their understanding of the subject, provide them with valuable entrepreneurship development skills and knowledge to commercially market their inventions.

Ashley Bhugwandin, manager of the Technology Localisation Implementation Unit (TLIU), an initiative of the Department of Science and Technology (DST), hosted at the CSIR, says that this intervention is important for South Africa since there are many individuals who lack formal education, but who are highly innovative.

"There are many innovators who are making a positive impact. However, if these individuals are assisted, for example with

design expertise and other technical skills, they will achieve greater reach."

"The idea is to take these individuals and transform them into entrepreneurs. We provide them with holistic support. We help grow their idea and then develop a business model around that idea," he says.

The programme was launched in March 2016 with three innovators and it currently has five innovators in the incubation programme.

Bhugwandin says that many of the innovators are creating solutions based on challenges experienced in their various communities to ensure that it can lead to a better life. Nkosana Madi started using his bicycle to commute to save money. He soon realised that he could use his passion for motorcycles to create a motorised bicycle to provide a cheaper form of transportation.

The Grassroots Innovation Programme has shown him how he can use environmentally friendly methods to make these bicycles and identify markets that can use his products.

After the development of a prototype of the first mobile computer numerically controlled machine, Phumlani Ntloko found that there was a massive demand for the testing of the viability of prototypes within communities. Ntloko had no formal training, but his idea caught the attention of the CSIR. Researchers are now assisting him to turn his idea into a business through the Grassroots Innovation Programme.

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Phumlani Ntloko, left, and Skhumbuzo Ndlovu of Adia Engineering Systems have developed a mobile computer numerically controlled (CNC) machine.



Ashley Bhugwandin of the CSIR with the motorised bicycle on display.

PLAYING WITH DNA FOR A LIVING

“I have made it my mission to understand how our DNA contributes to disease – specifically diseases that concern Africa.”

DR JANINE SCHOLEFIELD

Stem cell research gives us valuable information about some of the continent’s most threatening diseases, bringing us closer to finding preventions and cures. Janine, a geneticist at the CSIR, is making a significant contribution in this field. “The genes in our DNA don’t just determine the colour of your eyes or your blood type. They also play a role in cell function and susceptibility to disease,” Janine explains. Her passion for genetics led her to work with non-embryonic stem cell technology in her lab. As she puts it, “It’s such a valuable technique and could be used beautifully in combination with South Africa’s diverse genetic population – to uncover clues about disease susceptibility relevant to our country.”

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