wattnow

SAIEE THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | AUGUST 2023

MANUFACTURING

Serving Since 1909

Formed in 1909, The South African Institute of Electrical Engineers sports ± 6000 engineering professionals.

Why Join Us

Our members are professionally engaged in various engineering activities, including academic research, manufacturing, electronics, telecommunications, measurement and control, mining, and power infra-structural services. Members make meaningful contributions to the quality of life in communities and the steady advancement of technology. Their efforts are acknowledged in many countries worldwide.

Training Academy

We offer CPD training courses, a powerful learning tool to improve skills, ensuring that academic qualifications do not become outdated.

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One of our core objectives is to harness and foster the growth of Education in the Engineering sector, which has been faced with a debilitating shortage of skills.

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Corporates are invited to monthly forum meetings to discuss and brainstorm critical issues in South Africa and find solutions.

SAIEE

Our Purpose

To enhance the practice of electrical engineering in South Africa and the stature of our members through knowledge, networking, influence, education and communication.

Contact Us

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011 487 3003

www.saiee.org.za

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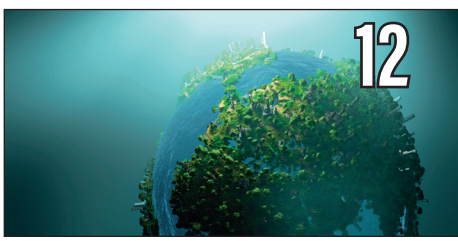

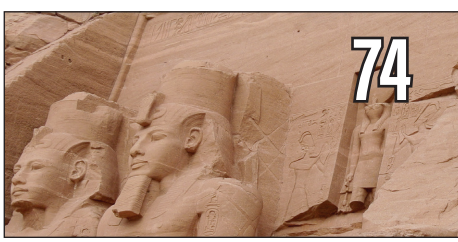

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Dear **watt**now reader,

According to the South African Reserve Bank, manufacturing is an important part of South Africa's economy, contributing 12% of GDP, 12% to formal sector employment and 42% of the rand value of exports in 2019. Manufacturing has strong linkages with various suppliers, supporting industries, mining and agriculture, and service providers.

Our first feature, on page 24, discusses the World Economic Forum's "2023 Future of Jobs Report". Since its first edition in 2016, the World Economic Forum's bi-annual Future of Jobs Report has tracked the labour-market impact of the Fourth Industrial Revolution, identifying the potential scale of occupational disruption and growth alongside strategies for empowering job transitions from declining to emerging roles.

We come home and look at the "Revitalising South Africa's Manufacturing Sector, on page 28. South Africa's manufacturing sector, similar to its global counterparts, is facing a host of new challenges on account of the implications of the ongoing COVID-19 pandemic – and this is over and above the pre-existing (i.e., pre-pandemic) sectoral and macroeconomic policy handicaps the sector has to contend with. The growing concerns for environmental sustainability, the rising consumer awareness about the significance of reducing the carbon footprint for all goods and services, and the escalation in energy cost in all its forms are a few examples of the constraints within which global manufacturing needs to redefine its operations.

I am happy to share the IEC Young Professionals essay winners from South Africa. Read their winning essays on page 74.

The September issue features Lightning, and the deadline is 21 August 2023. Please send your paper/article to: minx@saiee.org.za.

We are wishing all our Women a fabulous Women's Month! You are gorgeous in your own right!

Herewith the August issue; enjoy the read!

Call for Technical Posters for Students from High Schools & Higher Education Institutions

The Engineering Council of South Africa calls on High School Learners and Higher Education Students from around the world to enter the Technical Posters Competition by designing and submitting a poster that speaks to a Sustainable Development Goal (SDG) and addresses a real-life problem using an applicable, practical, and economical engineering solution in the context of Africa.

The Call for Technical posters is for the upcoming 9th African Engineering Week and 7th African Engineering Conference to be held at the Council for Scientific and Industrial Research (CSIR) from 25-28 September 2023.

The annual Conference to be held under the theme "Celebrating Engineering Excellence in the African Region" will be hosted by ECSA in collaboration with the Federation of African Engineering Organisations (FAEO), the World Federation of Engineering Organisations (WFEO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Categories of participants:
Two Categories of participation are available:
Category 1: High School Learners
Category 2: Undergraduate Students from Higher Education Institutions (Universities, TVET Colleges etc.).

POSTER REQUIREMENTS:

- The posters should be in English and contain the following information: (Title of the Poster, Learner/Student and School/Institution Name, SDG Addressed, Problem and Engineering Solution applied specifically for Africa).
- Participants are required to select one Sustainable Development Goal for the poster.
- **Teams:** A maximum of 3 individuals per team may participate.
- **Poster size:** Category 1: A1 pdf format | Category 2: A0 pdf format.

EVALUATION CRITERIA:

- **Creativity:** Uniqueness and Originality of the Idea, Innovation and Technical Accuracy – Innovative approach proven of sound engineering methodologies (engineering rigor).
- **Aesthetics:** Visually appealing, effective use of color, typography, and attractiveness of poster.
- **Overall Impact:** Relevancy of the solution to the problem and whether the solution is current to the field.

PRIZES:

EMAIL SUBMISSIONS TO:
AEW2023@ecsa.co.za

- Category 1 (High School Learners) – 1st Place: **US$300** | 2nd Place: **US$200** | 3rd Place: **US$100**
- Category 2 (Tertiary Students) – 1st Place: **US$400** | 2nd Place: **US$250** | 3rd Place: **US$150**

Note: Cash prizes shall be awarded per team in each category.

SUBMISSION DETAILS:

18th August 2023
Submission deadline

19th August – 30th August 2023
Review and Screening

30th August 2023
Notification of Approval of Posters (All those with approved posters will receive participation certificates)

31st August – 7th September 2023
Judging Process

10th September – 17th September 2023
Notification of Winning Candidates

ECSA
ENGINEERING COUNCIL OF SOUTH AFRICA

unesco

WORLD FEDERATION OF ENGINEERING ORGANIZATIONS

FAEO

INDUSTRY AFFAIRS

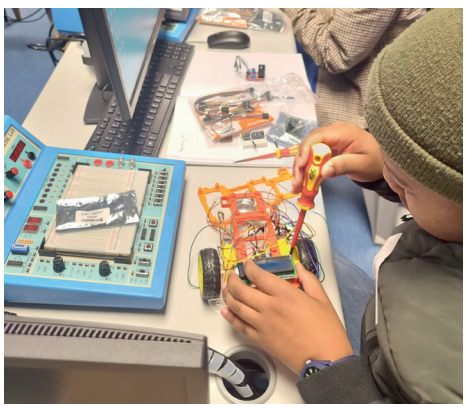
Robotics Student Training at CUT

- by Lucky Mokalusi | Organiser

Mr Lucky Mokalusi (organiser and facilitator), Prof. Ben Kotze (overseer), and Mr S.M. Mkhwanazi (reflections and photography) organised a Robotics Student Training, which was held over five days from 3rd to 7th July 2023. The training aimed to provide valuable technical skills and knowledge to students at the Central University of Technology (CUT) in partnership with Tshwane University of Technology (TUT), who provided expertise, merSETA, who provided training kits, and the South African Institute of Electrical Engineers (SAIEE) as the mother body. This was conducted as a community-based project to empower the students for future career opportunities in robotics.

The training program included a basic course for 20 students and an advanced course for 20 students, totalling 40. The training was free, and each student received complimentary training packages. Upon completion of the course, each student will receive a certificate from FH Aachen – University of Applied Sciences, one of the top technical German universities.

One of the critical aspects of organising such a training program is ensuring that we prepare our future graduates with the relevant skills for future work and allow them to become valuable members of our society who will participate in the development of technology in our nation and contribute to the well-being of the participants. wn



SAIEE Rand Water Zuikerbosch plant visit

- by Leanetse Matutoane | SAIEE CEO

The SAIEE requested a visit to the Rand Water Zuikerbosch plant near Three Rivers in Vereeniging, and the visit was approved for 12 April 2023. This visit, however, was cancelled at short notice due to unforeseen circumstances at Rand Water.

We were, fortuitously, allowed to visit the plant at a later stage. This happened on Thursday, 06 July 2023, with 12 members attending the visit. It started at the Training Centre, where all attending the visit were asked to convene in their PPE. A welcome tea & coffee with sandwiches was served for those who had left their abodes without having breakfast. A safety talk then took place after that, warning and informing all visitors of the inherent dangers within the different processes to be visited, which included an apt warning about the presence of snakes in certain external portions of the plant (luckily none were encountered!).

Following that, a highly informative and eye-opening address by the plant manager, Mr Eddie Singo, took place. I got into the bus at the plant to witness the water purification process. Everyone in attendance walked the process described during the morning kick-off session, starting with Abstraction, Coagulation, Flocculation, Sedimentation, Carbonation, Filtration, Disinfection and finally Pumping.

Knowledgeable Rand Water employees guided the various plants and processes, providing the technical information and fielding all the questions as they arose. At the end of the visit, all witnessed the control room, wherein all the different water pumping lines are visualised and controlled, the wonders of technology!

This visit highlighted the importance of water, saving it and the effort and technology that goes into one being able to pour and drink a simple glass of water. Special thanks to the Rand Water management for allowing the visit (Eddie Singo and colleagues), staff members who guided us, accompanied us, fielded our questions (Marcia, Brian, Itumeleng & Corne) and arranged logistics (Maxine). It truly is an exemplary and glorious national key point.

Thank you, Rand Water! wn

INDUSTRY AFFAIRS

Vodacom Century City fire highlights fire safety for PV systems

The fire at the Vodacom building at Century City in Cape Town on Sunday, 9 July, is suspected of having been caused by an issue with the rooftop solar photovoltaic (PV) installation. Such systems for homes and businesses are increasingly popular to mitigate the impact of ongoing load-shedding.

However, for insurance purposes, these need to be installed by an accredited installer or electrician, highlights ASP Fire CEO Michael van Niekerk. The onus is on home and business owners to ensure the installation is correct, especially regarding accompanying gensets.

"There are several fire safety measures that should be taken into account to prevent the risk of fires when installing a solar power system," says van Niekerk. Firstly, experienced professionals must install solar panels to prevent fires caused by faulty wiring or overheating.

Using high-quality solar panels, inverters, wiring, batteries, and other components from reputable manufacturers is important. Inferior quality components, especially in lithium-ion batteries, are more likely to malfunction, increasing the fire risk. Lithium-ion batteries not equipped with a thermal management system have a high chance of overheating, resulting in thermal runaway and subsequent fire.

Battery storage rooms must be fire-rated to control a battery fire, as these are exceptionally difficult to control and extinguish. The flammable gas produced during a Lithium-Ion battery fire can build up inside a garage or room and, if ignited, can result in an explosion with disastrous consequences.

Another critical consideration is using properly sized and rated wiring in the installation to prevent overheating, short circuits or other electrical problems that can lead to fires. Wiring should be insulated, and conduit used where necessary to protect the wiring from the elements. Faulty, poor quality or incorrectly installed solar panel junction boxes located outside on the roof can cause water to ingress the housing, leading to a short circuit and a subsequent fire that will result in a loss of the rooftop solar installation.

Install an isolation switch to shut the roof-mounted solar panels down safely in an emergency, says van Niekerk.

Such an isolation switch must be clearly labelled and easily accessible to the fire department. Solar panels' impact on smoke ventilation and emergency firefighting smoke ventilation in a soft roof building are also important factors to consider when designing solar panel installations.

In addition, a solar power system must be grounded to prevent electrical shocks and fires. All metal components, including the solar panels and storage batteries, must be grounded to a common ground point. Regular maintenance and inspection are critical to ensure all components function properly and identify potential fire hazards. wn

OBIT: An appreciation of the career of Nathan "Nat" Kirschner

By Antony Britten, Pr.Eng, FSAIEE

Nat Kirschner was a brilliant electrical engineer whose "stellar" career spans over 50 years.

Nat died in his 99th year on 22 January 2023 from complications caused by an earlier stroke. His passing was merciful and peaceful, surrounded by his wife Freda and family. Nat was a devoted husband and father and extremely proud of his status as a great-grandad. Nat is deeply mourned by his family, friends, and professional colleagues.

Nat was born on 30 June 1924, in Johannesburg, to a devout Jewish immigrant family. He attended primary school in Hillbrow and attended Parktown Boys High School from 1936 to 1940, where he excelled in academia and sport—particularly athletics, rugby, tennis and cricket. After matriculating, Nat attended Wits University, gaining a degree in electrical engineering. Joining the SA Defence Force in 1945, he served as a radar technician assisting in the search for U-boats still believed to have been operating off the Natal coastline.

After leaving the Defence Force in 1946, Nat joined Reyrolle Africa and became a managing director shortly after returning from Zambia in the early 1960s. Nat remained with Reyrolle until 1987 when he was appointed chairman of NEI Africa. In 1990, Nat served as non-executive chairman of Kennedy & Donkin Africa.

Nat was a very sophisticated, dignified and charming man. The SAIEE offer their condolences to Freda, Alan, Ruth and Jennifer. wn

UKZN SCOOPS THREE AWARDS AT 'SCIENCE OSCARS OF SA'

From left_Professor Glenda Gray (SAMRC), Dr Jennifer Molwantwa (WRC), Mr Mark Horan from the Centre for Water Resources Research (CWRR) receiving the award on behalf of Professor Jeff Smithers, Dr Mmboneni Muofhe (DSI).

The University of KwaZulu-Natal's (UKZN) College of Agriculture, Engineering and Science has won three of the acclaimed National Science and Technology Forum (NSTF)-South32 Awards for the 2022-2023 cycle.

The NSTF-South32 Awards - dubbed the 'Science Oscars of South Africa' were presented at a glitzy ceremony held concurrently in Johannesburg and Cape Town on Friday, 13 July.

The three awardees from the School of Agricultural, Earth and Environmental Sciences at UKZN are Professor Onisimo Mutanga, Professor Andrew Green and the Centre for Water Resources Research (CWRR) headed by Professor Jeff Smithers.

Acting Deputy Vice-Chancellor and Head of the College of Agriculture, Engineering and Science, Professor Fhatuwani Mudau, said, "We congratulate this outstanding achievement by our academics, which places UKZN at the forefront of cutting-edge and socially relevant SET research and capacity development within South Africa."

Professor Onisimo Mutanga won one of the two Engineering Research Capacity Development Awards sponsored by Eskom. Mutanga is the DSI/NRF/Nedbank SARChI Chair in Land Use Planning and Management and Professor of Remote Sensing at UKZN. Mutanga was recognised for developing research capacity through remote sensing techniques to support land use management, focusing on developing the science and applying these techniques to terrestrial ecosystems.

UKZN's Centre for Water Resources Research, under the directorship of Professor Jeff Smithers, who holds the Umgeni Water Chair in Water Resources Management, Innovation and Research at UKZN, won the NSTF Water Research Commission Award. The CWRR received recognition for providing a centre of excellence for cutting-edge applied and interdisciplinary research and postgraduate training in water resources-related research and capacity building. Research themes at the Centre include:

- Hydrological process studies.
- Hydrological model development.
- Agricultural water management.
- Land and water research.
- Measuring and modelling.
- The Centre also houses the uMngeni School of Water Governance.

Professor Andrew Green, a Marine Geology Professor at UKZN and Visiting Professor at the University of Ulster, Northern Ireland, won the Special Annual Theme Award: Ocean Science for Sustainable Development. Green was recognised for excellence in marine geoscience research, which forms the key to unlocking the blue economies of the world's oceans and protecting our coastlines from the effects of climate change. Green's research interests focus on marine geophysics, geomorphology, sedimentology and stratigraphy of coastal and marine environments.

The NSTF-South32 Awards recognise outstanding contributions to Science, Engineering and Technology (SET) and innovation in South Africa for researchers and other Science, Engineering and Technology (SET) related professionals.

The institution of the South32 Awards is part of the NSTF's vision to work towards a transformed country where SET and innovation contribute to a higher quality of life for all South Africans, and where the profiles of SET professionals are representative of the population and where the education system, particularly for SET and innovation, is effective. wn

INFORMATION REGULATOR (SOUTH AFRICA)

Ensuring protection of your personal information and effective access to information

MEDIA STATEMENT

INFRINGEMENT NOTICE AND R5 MILLION ADMINISTRATIVE FINE ISSUED TO THE DEPARTMENT OF JUSTICE AND CONSTITUTIONAL DEVELOPMENT FOR CONTRAVENTION OF POPIA

04 JULY 2023

On 03 July 2023, the Information Regulator (Regulator) issued an Infringement Notice to the Department of Justice and Constitutional Development (DoJ&CD) in which it ordered the DoJ&CD to pay an administrative fine of R5 million following its failure to comply with the Enforcement Notice issued by the Regulator on 09 May 2023.

The Regulator issued the Enforcement Notice following the finding of the contravention of various sections of the Protection of Personal Information Act (POPIA) by the DoJ&CD. The Enforcement Notice had required the DoJ&CD to submit proof to the Regulator within thirty- one (31) days of receipt of the Notice that the Trend Anti-Virus licence, the SIEM licence and the Intrusion Detection System licence have been renewed. It also required the department to institute disciplinary proceedings against the official/s who failed to renew the licences, which are necessary to safeguard the department against security compromises. The Regulator indicated that should the DoJ&CD fail to abide by the Enforcement Notice within the stipulated timeframe, "it will be guilty of an offence, in terms of which the Regulator may impose an administrative fine in the amount not exceeding R10 million, or liable upon conviction to a fine or to imprisonment of the responsible officials".

The thirty-one (31) days given to the department expired on 9 June 2023. To date, the department has not provided the Regulator with a report on implementation of the actions required in the Enforcement Notice or any other communication in that regard. The DoJ&CD had the right to appeal the Enforcement Notice in terms of section 97(1) of POPIA, and they have failed to exercise that right. Given this lack of compliance with the Enforcement Notice, the Regulator has made a determination that the department has failed to comply with the Enforcement Notice served to it in terms of POPIA. Accordingly, the Regulator has issued an administrative fine of R5 million to the department for failure to comply with the Enforcement Notice.
The DoJ&CD has 30-days from 03 July 2023 to pay the administrative fine or make arrangements with the Regulator to pay the administrative fine in instalments or elect to be tried in court on a charge of having committed the alleged offence referred in terms of POPIA.

For media enquiries, contact Ms Nomzamo Zondi at 078 674 2598 or Nzondi@inforegulator.org.za.

ISSUED BY THE INFORMATION REGULATOR OF SOUTH AFRICA.

NEW
training course!

POPIA
training course

"Gaining an insight, understanding, and application of the Protection of Personal Information Act 4 of 2013 (POPIA)"

- Equip yourself with the necessary knowledge to prevent penalties and fines that can be levied against you regarding the POPI Act.

6 – 7 September 2023
SAIEE House, Observatory, JHB

01 About the course

This training course includes an overview of the POPI Act and an understanding of why the purpose and implementation of this act are so crucial. It will provide an understanding of who the information regulator is, its purpose and powers, and where the information regulator is situated. It will guide registering an information officer of the company with the information regulator. The training will guide in ensuring compliance with the POPI Act and practical ways to become POPIA compliant. It will also focus on the do's and don'ts concerning the implementation of POPIA, the consequences of non-performance with POPIA, and the fines and penalties associated with non-performance of the POPI Act. We will also look at global data privacy examples.

02 Who should attend this course

This 2-day face-to-face course will train employees, chief executive officers, company owners, and anyone processing personal information.

Our Lecturer

Jodi
Poswelletski

Jodi is a director at Fairbridges Wertheim Becker Attorneys specialising in POPIA.

Book today!
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SAIEE Training Academy Brochure

REIPP ensures South Africa's Energy Future

THE BENEFITS OF THE REIPPPP HAVE THE POTENTIAL TO EXTEND EVEN FURTHER

By Nato Oosthuizen
BDO South Africa's Partner and Renewable Energy Expert

Touted as one of the world's best renewable energy tenders, South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has paved the way for the private sector and Independent Power Producers (IPPs) to invest in the country's renewable energy market. However, there could be an additional benefit that may not have been considered yet, says Nato Oosthuizen, Partner and Renewable Energy Expert at BDO.

Since its inception in 2011, REIPPPP has enabled 89 IPPs to provide the country with a steady stream of over 6000MW of renewable energy. With expectations that energy procured in Bid Windows 3 and 4 will bring a further 100MW and 75MW online in 2024, and with three projects under Bid Window 5 having started construction with an investment value of over R12 billion, we may not be exactly on target, but progress is certainly positive.

But while the country waits – often in increasingly higher stages of darkness – for these projects to reach completion, is there not perhaps an opportunity to shed some light on the local communities where construction is taking place instead of shedding more of the load?

As part of the REIPPPP bid process, approved IPPs are tasked to contribute towards local community development through socio-economic and enterprise development, local ownership and local job creation. These requirements must be fulfilled within a 50km radius of the project and oblige renewable energy companies to engage with the developmental opportunities and needs of communities around their project sites. Awarded projects must spend some of their generated revenue on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities.

The most critical aspect of the SED and ED element is that initiatives should result in sustainable economic participation by its intended beneficiaries and discourage perpetual dependence on hand-outs. Often, this doesn't happen as initiatives may start successfully but then dry up as donations get used towards overhead structures or the initiative simply doesn't have staying power and eventually fizzles out, leaving communities high and dry.

THE MAJOR IMPACT OF MINI-GRIDS

Most REIPPPP projects are being implemented in rural areas primed with natural resources such as solar or wind. What if, instead of the revenue going to various SED and ED initiatives, the government mandated this money to be specifically spent on electricity-related projects within the community – such as building mini-grids that supply power to the community?

This would result in many of the country's most vulnerable being able to reap the immediate and long-term benefit of access to electricity and become active participants in their own economic freedom.

HOW?

Project development teams have specific skills in creating power-generating facilities and could probably negotiate a good price with the engineering, procurement and construction (EPC) contractor building their own plant. That EPC contractor can then build a smaller plant simultaneously in the rural communities, and the project can claim the costs back from the ED or SED fund.

This way, the development of mini-grids can be pre-funded and accelerated by experienced individuals. Furthermore, these grids' annual operation and maintenance (O&M) can be maintained by the same O&M provider that services the primary project.

To take it one step further, local community members could be trained to maintain, run and even provide security for the mini-grid, substantially increasing skills development and driving local job creation. This approach would provide an opportunity for those with the competence to become a much larger player in the solution through a two-pronged approach that creates a sustainable renewable energy source and empowers a local community simultaneously.

Probably the most compelling reason this approach should be considered is that IPPs are signing a 20-year contract that locks them into the community for the long term. These are not fly-by-night initiatives that are swooping in, giving a handout, and disappearing. These institutions have the skill, the staying power and the funds to impact the power crisis by being part of the solution.

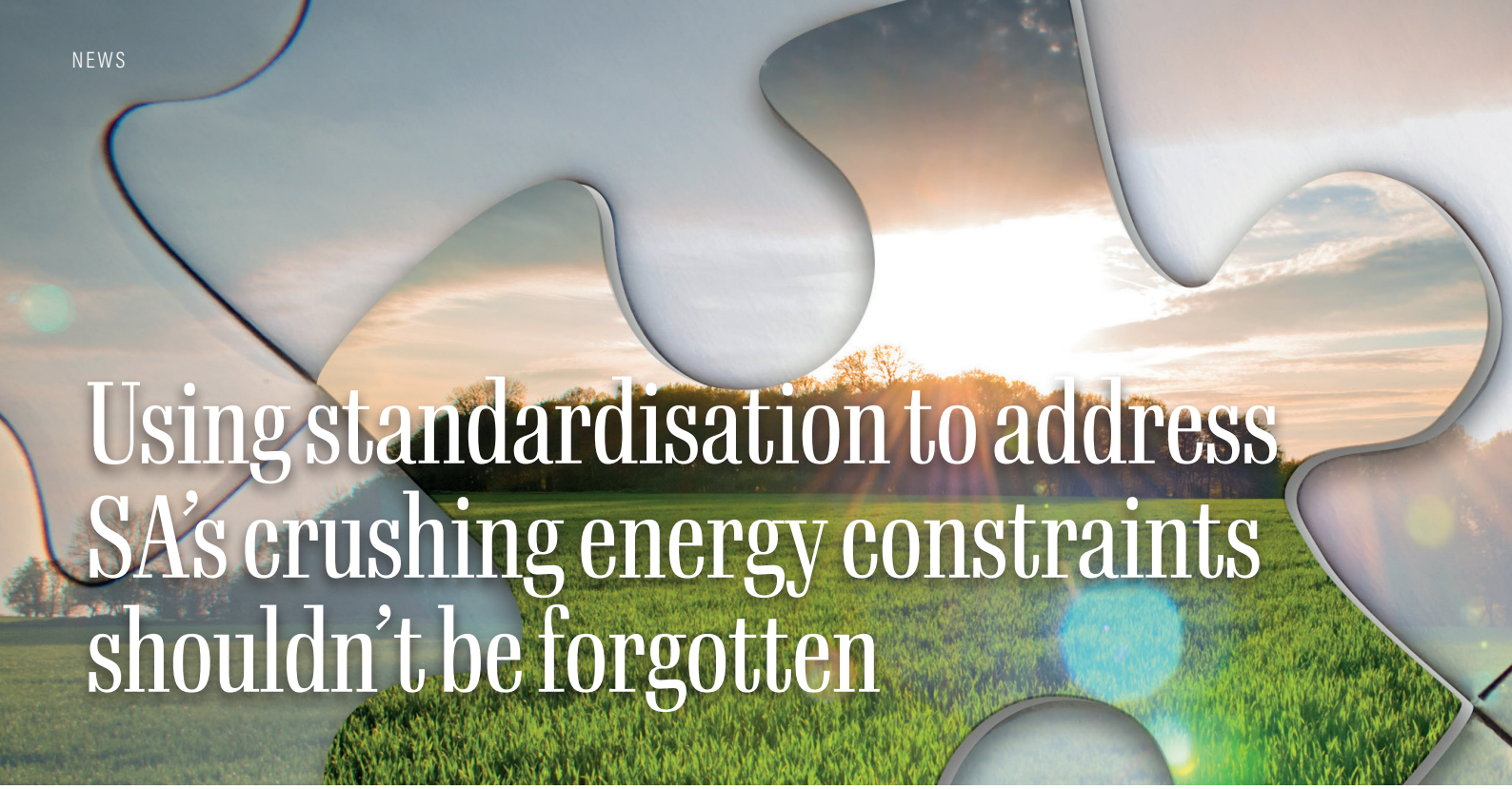
PRACTICAL EXAMPLE

Assume the development of a 100MW solar project where a community trust would be granted a 5% funded shareholding and 2.5% of revenue would be paid to SED/ED contributions for local development.

Rather than giving 5% funded shareholding, construct a 5MW (5% of 100MW) solar plant close to the local community. The funding and repayment of this project costs would be funded by the main project, as it would be allowed to build a full-size plant of 100MW still and earn 100% of the return thereon, rather than having a lower percentage shareholding in the total project. The main project can also pay the O&M cost, Insurance, Security, Management fees, etc., for running the project, substituting the payment of previously committed SED/ED costs. The synergies that can be obtained through this cost absorption make it feasible for a smaller project to be financially and technically viable.

The ownership of the project can be housed in a Non-profit Organisation. The electricity (or excess) generated by this plant, if not used by the community, can be sold to the local community, municipality or industry at discounted prices, with the proceeds used for community projects (i.e. SED/ED-type projects). Hence, the community will directly benefit again by paying for electricity (even at reduced prices).

Suppose we have the power to harness resources that spark self-sufficiency. Shouldn't we explore every way possible to find solutions that can be felt sooner and last exponentially longer? wn



Using standardisation to address SA's crushing energy constraints shouldn't be forgotten

A timeous, stress- and money-saving measure will make a significant difference to the life of an organisation.

No business in South Africa isn't hurting because of load-shedding.

While there were several months of relative "reprieve" in the form of Stage 2 and 3 blackouts, the colder weather has prompted Eskom to announce a return to Stage 6 levels.

Economists say there won't be any let-up in summer, as this is traditionally when the power utility undertakes plant and system maintenance.

It is estimated that load-shedding has already cost South Africa some R1.2-trillion.

Though efforts are being made to source privately produced energy to pump into the grid, this is a drawn-out process that, for the moment, is having little to no impact on businesses having to spend small fortunes on generators to maintain day-to-day operations.

Solar solutions are certainly on many companies' radars, and while expensive, these do make a difference.

But alternative energies are not the only mitigation measure that can be employed, says Gareth Swart, senior process engineer at South African International Organisation for Standardisation (ISO) specialist WWISE.

ISO 50001:2018, for example, is an international standard that provides a framework for organisations to establish, implement, maintain and improve an energy management system (EnMS).

Implementation helps businesses to enhance their energy performance, increase energy efficiency, and reduce energy-related costs and environmental impacts.

"By following the standard's guidelines, they can establish clear roles and responsibilities, define processes and set targets for energy performance improvement. This streamlines operation, reduces ambiguity, and saves time that would otherwise be spent on ad hoc energy management approaches," Swart says.

Costs are also reduced, and waste is minimised through energy efficiency improvements. Furthermore, better operational effectiveness may result in cost savings in other business areas.

ISO 50001:2018 works by:

- Establishing the EnMS to develop a systematic approach to managing energy. This includes defining an energy policy, setting energy objectives and establishing a team responsible for implementing and maintaining the EnMS;
- Conducting an energy review to identify significant energy uses and consumption patterns. Based on this review, the organisation can establish energy performance indicators and set targets to improve

energy efficiency and reduce energy consumption;

- Establishing a baseline of energy consumption and performance. This provides a reference point to measure improvements and track progress over time;
- Improving energy performance through the implementation of energy management best practices and technologies. This can include measures such as optimising processes, upgrading equipment, implementing energy-efficient technologies and promoting employee awareness and engagement;
- Measuring and monitoring the organisation's energy consumption and performance data. This helps identify areas for improvement, evaluate the effectiveness of energy-saving initiatives, and make data-driven decisions; and
- Regularly conducting management reviews to evaluate the EnMS's performance, identifying opportunities for improvement and making informed decisions regarding resource allocation and strategic direction.

Swart points out that the standard emphasises data-driven decision-making through measuring and analysing energy performance data.

"By collecting and analysing energy-related information, organisations gain insights into their energy usage patterns, identify areas for improvement and make informed decisions regarding energy management initiatives. This helps prioritise resources, allocate budgets effectively, and reduce the risk of investing in ineffective energy-saving measures."

Also important to note is that ISO 50001 promotes a culture of energy awareness and engagement throughout an organisation. By involving employees in these initiatives, they can tap into their knowledge, ideas and enthusiasm for energy-saving.

Swart adds that companies should regularly review their energy performance and aim to set new objectives. "By continuously striving for improvement, businesses can adapt to changing energy constraints, technologies and market conditions, reducing the stress associated with sudden energy-related challenges."

Implementing ISO 50001 can take anywhere between six months and two years, depending on the maturity and complexity of the organisation's processes.

Effective leadership is crucial, Swart says.
"Leadership needs to be committed to reducing energy consumption throughout the organisation. To ensure that the energy management system is working coherently and consistently, the organisation must establish and standardise how it carries out day-to-day operations and address irregularities and opportunities for improvement.

"This helps to reduce variation in energy consumption and bring the organisation closer to its objectives, ensuring sustainable, long-lasting energy and cost benefits." wn

Using standardisation to address SA's crushing energy constraints shouldn't be forgotten:

A TIMEOUS, STRESS- AND MONEY-SAVING MEASURE WILL MAKE A SIGNIFICANT DIFFERENCE TO THE LIFE OF AN ORGANISATION

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Though efforts are being made to source privately produced energy to pump into the grid, this is a drawn-out process that, for the moment, is having little to no impact on businesses having to spend small fortunes on generators to maintain day-to-day operations.

Solar solutions are certainly on many companies' radars, and while expensive, these do make a difference.

But alternative energies are not the only mitigation measure that can be employed, says Gareth Swart, senior process engineer at South African International Organisation for Standardisation (ISO) specialist WWISE.

ISO 50001:2018, for example, is an international standard that provides a framework for organisations to establish, implement, maintain and improve an energy management system (EnMS).

Implementation helps businesses to enhance their energy performance, increase energy efficiency, and reduce energy-related costs and environmental impacts.

"By following the standard's guidelines, they can establish clear roles and responsibilities, define processes and set targets for energy performance improvement. This streamlines operations, reduces ambiguity, and saves time that would otherwise be spent on ad hoc energy management approaches," Swart says.

Costs are also reduced, and waste is minimised through energy efficiency improvements. Furthermore, better operational effectiveness may result in cost savings in other business areas.

ISO 50001:2018 works by:

- Establishing the EnMS to develop a systematic approach to managing energy. This includes defining an energy policy, setting energy objectives and establishing a team responsible for implementing and maintaining the EnMS;
- Conducting an energy review to identify significant energy uses and consumption patterns. Based on this review, the organisation can establish energy performance indicators and set targets to improve energy efficiency and reduce energy consumption;
- Establishing a baseline of energy consumption and performance. This provides a reference point to measure improvements and track progress over time;
- Improving energy performance by implementing energy management best practices and technologies. This can include measures such as optimising processes, upgrading equipment, implementing energy-efficient technologies and promoting employee awareness and engagement;

- Measuring and monitoring the organisation's energy consumption and performance data. This helps identify areas for improvement, evaluate the effectiveness of energy-saving initiatives, and make data-driven decisions; and
- Regularly conducting management reviews to evaluate the EnMS's performance, identifying opportunities for improvement and making informed decisions regarding resource allocation and strategic direction.

Swart points out that the standard emphasises data-driven decision-making through measuring and analysing energy performance data.

"By collecting and analysing energy-related information, organisations gain insights into their energy usage patterns, identify areas for improvement and make informed decisions regarding energy management initiatives. This helps prioritise resources, allocate budgets effectively, and reduce the risk of investing in ineffective energy-saving measures."

Also important to note is that ISO 50001 promotes a culture of energy awareness and engagement throughout an organisation. By involving employees in these initiatives, they can tap into their knowledge, ideas and enthusiasm for energy-saving.

Swart adds that companies should regularly review their energy performance and aim to set new objectives. "By continuously striving for improvement, businesses can adapt to changing energy constraints, technologies and market conditions, reducing the stress associated with sudden energy-related challenges."

Implementing ISO 50001 can take anywhere between six months and two years, depending on the maturity and complexity of the organisation's processes.

Effective leadership is crucial, Swart says.

"Leadership needs to be committed to reducing energy consumption throughout the organisation. To ensure that the energy management system is working coherently and consistently, the organisation must establish and standardise how it carries out day-to-day operations and address irregularities and opportunities for improvement.

"This helps to reduce variation in energy consumption and bring the organisation closer to its objectives, ensuring sustainable, long-lasting energy and cost benefits." wn

Making your business future-proof through digital transformation:

AFRICAN SAP USERS EMBRACE FIRST HYBRID SAPHILA CONFERENCE

After a four-year absence, delegates and presenters alike were delighted to be back for the 2023 iteration of SAPHILA, the African SAP User Group's (AFSUG) official biennial conference for SAP users, taking place at Sun City, North West Province, on 10 and 11 July 2023.

The conference was opened by Master of Ceremonies, 702 journalist Bongwani Bingwa, who noted: "Technology is moving ahead in leaps and bounds and changing the way we live and work. It plays a huge role in helping to make the seemingly impossible, possible."

SAPHILA is a highly-regarded platform for communication, collaboration and connection for the local SAP community, with this year's theme 'ASPIRE' being defined as 'directing one's hopes and ambitions towards achieving new heights and goals'. The ASPIRE theme is also closely aligned with the 'RISE with SAP' offering, which encourages driving business innovation through collaboration, with the aim of building intelligent, sustainable enterprises in the cloud.

Bingwa, who was speaking to the over 1,000 delegates who packed out one of Sun City's largest venues, was joined briefly by fellow 702 presenter Aki Anastasiou, this year's MC of the virtual conference, being run in parallel with the physical event for the first time.

Reg Barry, SAPHILA Chairman at AFSUG, thereafter clarified during his welcome address: "It is a privilege to come together as a community again after four years, in what we are proud to present as SAPHILA's first true hybrid event, thereby allowing more delegates than ever to join the community, including participants from around the world and not only in South Africa."

Barry commented that, while the conference is of course primarily aimed at African SAP users, delegates from outside the continent also included representatives from Germany, the UK, Sweden, Denmark, the United Arab Emirates, India, Australia, Kazakhstan, and Canada.

Having briefly welcomed the delegates, Barry then introduced the newly-appointed Managing Director of SAP Southern Africa, Kholiwe Makhohliso, who acknowledged the importance of the delegates, as SAP's customers and partners, and how SAP takes pride in assisting them on their AI and sustainability journeys, 'confidently, responsibly and mindfully'.

KEYNOTE SPEAKER: VUSI THEMBEKWAYO: 'SPEAKER, INVESTOR, LEADER: FUTURE-NOMICS'

Renowned local speaker Vusi Thembekwayo, who is a previous World Championship Public Speaking winner, centred his presentation around the theme of 'How is greatness achieved?' - while noting upfront that, in his opinion, it is a choice. He further clarified that: 'If you change the context, the competencies don't translate', advising that it is important, during ongoing periods of change, for businesses to understand which core competencies need to stay, and which must be stripped from the business, when planning the future of your company. He further noted that, in building a system of connected intelligence, it is important for members of the business to trust each other, collaborate and share information and resources.

Thembekwayo concluded his presentation by presenting four factors which should be taken into account in the economic context of turning the business into a success:

- Find the truth: Here he said that the former chairman of Pick n Pay, Raymond Ackerman, made a point of walking around his stores weekly

in order to be able to talk to his customers personally.

- Size is not everything: Thembekwayo advised businesses to 'Be your best self, not necessarily your biggest self.'
- Vision excites people, not numbers: "Martin Luther King said: 'I have a dream' - not a spreadsheet!" noted Thembekwayo
- Lead by the business case: He advised that companies should take care 'not to hold the future hostage to the present because they prefer the past.'

Finally, Thembekwayo concluded with an anecdote from a previous meeting he had held with former South African President and Nobel Peace Prize Winner, Nelson Mandela, when he himself was aged 15 and had asked: "Tata, what is your hope for South Africa?"

Replied Mandela: "South Africans need a little bit of faith," to which the young Thembekwayo responded: "What is faith?", to be advised: "Faith is the ability to believe in the impossible, see the invisible and trust in the unknown."

KEYNOTE SPEAKER: SVEN DENECKEN: 'HOW TO MANAGE THE DYNAMICS OF INDUSTRY DIGITAL TRANSFORMATION'

Sven Denecken, Senior Vice President, Chief Marketing and Solutions Officer for Industries and CX, SAP SE Germany, advised that SAP places a critical emphasis on its customers and partners, and addressing their needs in order to facilitate the best possible customer experience.

Said Denecken: "Technological innovations are able to facilitate significant impacts on business models, operations and productivity. Today, there is a growing demand for innovation, real-time data analysis, and faster response time. There is so much that we need to learn together about the speed of everyday transformation: it is a journey and not a destination.

"At SAP, we do know industries, and are aware that the industries you work in define your business. At the vertical edge this is often a game changer. With SAP's 50 years' of experience, we want to make our customers' businesses future-proof. In Africa, we are well connected to the rest of the world, and know that Africa can leapfrog experiences that others have made using today's technology. In this way, SAP assists in making you future-ready - we help you to navigate the trends."

Denecken added that we are today seeing an industry convergence, whereby companies are realising that they are not necessarily in only one sector. "Industries are coming together and being more creative," he explained, "and this is blurring the lines between the value chains a business is part of. As an example, SAP has spearheaded an example whereby e-mobility is also able to venture into retail. By facilitating the presence of an electric vehicle charger next to a grocery store, the energy company involved is enriching the customers' experience by combining e-mobility requirements with a retail experience and, further, contributing additionally by adding in the potential of a rewards system."

With regards to the growing popularity and influence of artificial intelligence (AI), Denecken noted that organisations must understand the business relevance of the AI possibilities. "AI should built into the company's processes," he advised. "Don't bolt AI onto your systems, but instead ensure that you make it an integral part of your business processes in a way that is relevant."

"Where is the technology of AI going, and how can it help us?" asked Denecken. "SAP believes that, by powering innovation, we are able to shape industries in a collaborative manner. We look at the possibilities of interacting and sharing data and expertise - together. This is how we see the future unfolding," he concluded. wn

Africa Prize 2023:

WINNERS ANNOUNCED

Two innovators won the Africa Prize for Engineering Innovation for the first time: South African Edmund Wessels and Ugandan Anatoli Kirigwajjo.

Edmund Wessels, a South African biomedical engineer, and Anatoli Kirigwajjo, a Ugandan electrical engineer, have jointly won the Royal Academy of Engineering's 2023 Africa Prize for Engineering Innovation.

YUNGA

Kirigwajjo wins with YUNGA, a local digital security network that connects neighbours and police within a 20-kilometre radius through a physical device, smartphone app or SMS service, providing security at low cost. Nearly 1,000 households in 30 communities across central Uganda are already on the YUNGA network, successfully preventing around 130 break-ins and related crimes. The team aims to connect 32,000 households across Uganda in the next two years.

"I developed YUNGA after losing USD 1,300 worth of assets in a break-in, with little chance of the thieves being caught. We hope that with our household networks, communities will become harder targets for criminals. This will ensure safety, creating the space for economic activities to thrive," says Kirigwajjo.

He and his co-founders, Kawesa Nasser and Kasoma Fredrick, say that winning the Africa Prize will expose their business to new markets across Africa. "It will open the door to additional resources such as investments and stakeholder partnerships. The prize money will allow us to add more than 1,000 households to the YUNGA network, focusing on women-led homes, which are more vulnerable to crime in low-resource settings. This is an invaluable opportunity in our efforts to scale up," adds Kirigwajjo.

In the YUNGA network, communities are divided into networks of 10 to 30 households, each receiving a device connected to a local area network. In cases of emergency, pressing a button sets off a loud alarm on all devices connected to the network. It sends a message with the victim's details to other devices, prompting a community response. The system includes motion sensors for when users leave their homes or businesses. YUNGA also operates in areas without internet through a long-range wide area network. YUNGA reduces response times by hours to the shortest time possible for network members to reach someone in danger.

"YUNGA revolutionises communication in low-resource areas, providing a digital network for swift and efficient responses to crimes and enhancing community safety. YUNGA aims to reach more than 30,000 households and 150,000 individuals by 2025," says Kirigwajjo.

"The Africa Prize programme has already helped us become more investment-ready, raise capital, improve and market our product, and grow our customer base by almost 60%!"

FLEXIGYN

Wessels wins with FlexiGyn, a battery-powered, portable handheld device that enables gynaecologists to diagnose and treat women's uterine problems without anaesthetic or expensive equipment. It aims to increase women's access to reproductive healthcare, particularly in remote areas.

Typical hysteroscopy systems are rigid, leading to high levels of patient discomfort and requiring bulky additional equipment for visualisation. The innovative FlexiGyn features a flexible scope with built-in light and camera, offering a more comfortable and efficient experience for both patients and healthcare providers.

"My co-founder, Chris Meunier and I aim to bring healthcare to a woman's doorstep, precisely when and where they need it. FlexiGyn is portable, intuitive and user-friendly, allowing gynaecologists to offer quality screenings and timely interventions regardless of the patient's location or lack of medical infrastructure. At the same time, it is designed to minimise discomfort," says Wessels.

"We are excited beyond belief to win the Africa Prize and know that this will help to get our name out and find the right partners to complete FlexiGyn's journey."

In addition to the hardware, Wessels and his team are developing integrated software solutions that seamlessly connect the FlexiGyn device with existing medical practice systems, including obstetricians and gynaecologists to general practitioners, radically increasing the frequency of diagnoses. Streamlining patient scheduling, electronic health record synchronisation and AI-assisted diagnosis, this improved efficiency and collaboration enable healthcare professionals to diagnose and treat patients more frequently, enhancing the overall quality of care.

"Winning the Africa Prize enhances our purpose to make women's healthcare convenient and accessible. The more visibility we get, the more likely others will start to innovate in this space too, solving problems for the people who need it most," says Wessels.

AFRICA PRIZE

Wessels and Kirigwajjo have each been awarded first prize for the Africa Prize for Engineering Innovation, taking home £25,000 to develop their products further. Four finalists delivered pitches at the awards ceremony held today in Accra, Ghana before a panel of judges chose the winners.

Africa Prize judge Rebecca Enonchong FREng said, "Home security is an everyday issue for so many people across Africa – we see huge potential for Anatoli's innovation to transform lives and empower communities to secure their homes, so we are delighted to award YUNGA the Africa Prize. We believe Edmund's innovation has the potential to help so many women who struggle to access reproductive healthcare and are very pleased to award FlexiGyn the Africa Prize as well. We look forward to seeing the impact of both innovations in Africa in the coming years."

The Africa Prize for Engineering Innovation, founded by the Royal Academy of Engineering in the UK, is Africa's biggest prize dedicated to supporting and upscaling engineering innovation and, after nine years, has a proven track record of identifying successful engineering entrepreneurs. More than 70% of the alumni's engineering and technology businesses now generate revenue. Between them, the Africa Prize alumni have raised more than USD 14 million in grants and equity funding and created more than 3,600 jobs, almost half for women.

This year's 15 shortlisted Africa Prize entrepreneurs from 10 countries in sub-Saharan Africa received eight months of training and tailored mentoring, including support with developing business plans, recruitment, IP protection, financing and commercialisation. The Africa Prize also promotes and connects the shortlisted entrepreneurs to individuals and networks worldwide who can accelerate their business and provide support with technology development – from fellow entrepreneurs and mentors to potential investors and suppliers.

The two other finalists, who each receive £10,000, are:

- Revive Kit, Chukwuemeka Eze, Nigeria – An e-mobility service that converts gas-powered three-wheel motorbikes to run-on batteries, saving up to 60% on running costs.
- WAGA PAWA Pack, Gibson Kawago, Tanzania – A power pack with recycled laptop batteries to provide reliable and affordable power for electric bikes, power banks, solar lights, businesses and homes.

In addition to the Africa Prize, the remaining 11 innovators from the 2023 shortlist competed for the One to Watch prize. They presented their innovations to a live audience who voted for the pitch with the most potential for impact.

Tolulope Olukokun was selected as the winner of the Africa Prize's One-to-Watch Award of £5,000. This Award recognises the potential of Olukokun innovation, an electric cargo bike with a battery-powered fridge to help Nigeria's smallholder farmers get fresh food crops to market. wn

ACTOM MV SWITCHGEAR INSTALLED A SOLAR GENERATION SYSTEM AT ITS KNIGHTS FACILITY

ACTOM recently approved the first solar power generation system installed at the group's main factory complex at Knights, Germiston.

MV Switchgear is the largest consumer of power among the various manufacturing divisions at the Knights site and was selected as the first division to be equipped with a solar generation system.

ACTOM plans to progressively introduce solar generation systems at other factories on the Knights site and group factories and workshops elsewhere in Gauteng and around the country in due course.

The solar installation at MV Switchgear, which went into operation in July this year after installation and commissioning was completed in June, is a grid-tied PV solar system that is designed to generate around 1MW of power, which is approximately the division's power consumption at peak load and about 50% of the peak load drawn by all the factories at the Knights site.

"We consequently expect the system to reduce the Knights site power consumption from the national grid by up to 50%, which represents a significant cost saving for us," commented Rhett Kelly, MV Switchgear's Design & Development Manager, who added that the reduction in power consumption from the grid can only be roughly estimated at this early stage since the solar generation system has not yet been in operation for long enough for a more accurate figure to be determined.

"MV Switchgear's energy consumption and thus electricity bill is expected to drop by up to 75%. This figure will naturally depend on the weather and the degree of operations carried out during the night hours when the solar system cannot generate power," he added.

The system comprises two identical 550kW grid-tied PV solar-powered inverter installations, which have been installed at the two major transformer locations in MV Switchgear's network supplying power to various parts of its extensive factory, with the solar panels that are installed on the main factory roof being linked to the inverter stations located at these two transformer locations.

Each inverter station comprises five 110kW inverters, an inverter collector box and a data management system. "Each inverter system is tied into the low voltage electrical installation of its respective main distribution board. Suppose the power generated at the inverter station exceeds the power demand at its respective location. In that case, any excess power generated is back-fed via the transformer into the Knights site 11kV ring network and can be used to supplement the power demands at other locations on the site, thus ensuring that no PV-generated power goes unused," said Rhett.

Johan Jordaan, MV Switchgear's Technology Development Specialist, further explained: "The system operates without battery backup and therefore requires an AC (50Hz) mains supply to support the load when inconsistent or no power can be generated from the solar panels due to overcast conditions or at night. By definition, a grid-tied solar generation system without a battery storage system cannot operate in isolation, its aim and purpose being to reduce the energy consumed from the grid."

For some time, the division has been well-equipped with diesel-powered generators as an alternative source of 50Hz AC power to the mains supply from the grid, such as typically – and increasingly in recent times – is the case when load-shedding occurs.

"Here again, as with mains supply from the grid, our adoption of solar-generated power allows us to reduce our dependence on expensive diesel power generation. We cannot do without it, but now, thanks to having brought solar generation into play, we require it less than previously and can achieve substantial energy cost savings as a result," Johan stated. wn

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2023 Future of Jobs Report

Since its first edition in 2016, the World Economic Forum's bi-annual Future of Jobs Report has tracked the labour-market impact of the Fourth Industrial Revolution, identifying the potential scale of occupational disruption and growth alongside strategies for empowering job transitions from declining to emerging roles.

In 2023, labour-market transformations driven by technological breakthroughs, such as the coming of age of generative artificial intelligence (AI), are being compounded by economic and geopolitical disruptions and growing social and environmental pressures.

The fourth edition of the Future of Jobs Report therefore broadens its scope beyond technological change to also consider and address the labour-market impact of a multitude of concurrent trends, including the green and energy transitions, macroeconomic factors, and geo- economic and supply-chain shifts.

Similar to previous editions, the core of the 2023 Future of Jobs Report is based on a unique survey- based data set covering the expectations of a wide cross-section of the world's largest employers related to job trends and directions for the 2023— 2027 period. This year's report brings together the perspectives of 803 companies – collectively employing more than 11.3 million workers – across 27 industry clusters and 45 economies from all world regions.

After widespread instability in the last three years across the world of work, we hope the outlook provided in this report will contribute to an ambitious multistakeholder agenda to better prepare workers, businesses, governments, educators and civil society for the disruptions and opportunities to come, and empower them to navigate these social, environmental and technological transitions. The time is ripe for business leaders and policy-makers to decisively shape these transformations and ensure that future investments translate into better jobs and opportunities for all.

KEY FINDINGS

Economic, health and geopolitical trends have created divergent outcomes for labour markets globally in 2023. While tight labour markets are prevalent in high-income countries, low- and lower-middle-income countries continue to see higher unemployment than before the COVID-19 pandemic. On an individual level, labour-market outcomes are also diverging, as workers with only basic education and women face lower employment levels. At the same time, real wages are declining as a result of an ongoing cost-of- living crisis, and changing worker expectations and concerns about the quality of work are becoming more prominent issues globally.

The fourth edition of the Survey has the widest coverage thus far by topic, geography and sector. The Future of Jobs Survey brings together the perspective of 803 companies – collectively employing more than 11.3 million workers – across 27 industry clusters and 45 economies from all world regions. The Survey covers questions of macrotrends and technology trends, their impact on jobs, their impact on skills, and the workforce transformation strategies businesses plan to use, across the 2023-2027 timeframe.

Technology adoption will remain a key driver of business transformation in the next five years. Over 85% of organizations surveyed identify increased adoption of new and frontier technologies and broadening digital access as the trends most likely to drive transformation in their organization. Broader application of Environmental, Social and Governance (ESG) standards within their organizations will also have a significant impact. The next most-

impactful trends are macroeconomic: the rising cost of living and slow economic growth. The impact of investments to drive the green transition was judged to be the sixth-most impactful macrotrend, followed by supply shortages and consumer expectations around social and environmental issues. Though still expected to drive the transformation of almost half of companies in the next five years, the ongoing impact of the COVID-19 pandemic, increased geopolitical divisions and demographic dividends in developing and emerging economies were ranked lower as drivers of business evolution by respondents.

The largest job creation and destruction effects come from environmental, technology and economic trends. Among the macrotrends listed, businesses predict the strongest net job-creation effect to be driven by investments that facilitate the green transition of businesses, the broader application of ESG standards and supply chains becoming more localized, albeit with job growth offset by partial job displacement in each case. Climate change adaptation and the demographic dividend in developing and emerging economies also rate high as net job creators. Technological advancement through increased adoption of new and frontier technologies and increased digital access are expected to drive job growth in more than half of surveyed companies, offset by expected job displacement in one-fifth of companies. The net job creation effect places these two trends in 6th and 8th place respectively.

The three key drivers of expected net job destruction are slower economic growth, supply shortages and the rising cost of inputs, and the rising cost of living for consumers. Employers also recognize that increased geopolitical divisions and the ongoing impact of the COVID-19 pandemic will drive labour-market disruption – with an even split between employers who expect these trends to have a positive impact and employers who expect them to have a negative impact on jobs.

Within technology adoption, big data, cloud computing and AI feature highly on likelihood of adoption. More than 75% of companies are looking to adopt these technologies in the next five years. The data also shows the impact of the digitalization of commerce and trade. Digital platforms and apps are the technologies most likely to be adopted by the organizations surveyed, with 86% of companies expecting to incorporate them into their operations in the next five years. E-commerce and digital trade are expected to be adopted by 75% of businesses. The second-ranked technology encompasses education and workforce technologies, with 81% of companies looking to adopt these technologies by 2027. The adoption of robots, power storage technology and distributed ledger technologies rank lower on the list.

The impact of most technologies on jobs is expected to be a net positive over the next five years. Big data analytics, climate change and environmental management technologies, and encryption and cybersecurity are expected to be the biggest drivers of job growth.

Agriculture technologies, digital platforms and apps, e-commerce and digital trade, and AI are all expected to result in significant labour- market disruption, with substantial proportions of companies forecasting job displacement in their organizations, offset by job growth elsewhere to result in a net positive. All but two technologies are expected to be net job creators in the next five years: humanoid robots and non-humanoid robots.

Employers anticipate a structural labour market churn of 23% of jobs in the next five years. This can be interpreted as an aggregate measure of disruption, constituting a mixture of emerging jobs added and declining jobs eliminated. Respondents to this year's Future of Jobs Survey expect a higher-than-average churn in the Supply Chain and Transportation and Media, Entertainment and Sports industries, and lower-than-average churn in Manufacturing as well

as Retail and Wholesale of Consumer Goods. Of the 673 million jobs reflected in the dataset in this report, respondents expect structural job growth of 69 million jobs and a decline of 83 million jobs. This corresponds to a net decrease of 14 million jobs, or 2% of current employment.

The human-machine frontier has shifted, with businesses introducing automation into their operations at a slower pace than previously anticipated. Organizations today estimate that 34% of all business-related tasks are performed by machines, with the remaining 66% performed by humans. This represents a negligible 1% increase in the level of automation that was estimated by respondents to the 2020 edition of the Future of Jobs Survey. This pace of automation contradicts expectations from 2020 survey respondents that almost half (47%) of business tasks would be automated in the following five years.

Today, respondents have revised down their expectations for future automation to predict that 42% of business tasks will be automated by 2027. Task automation in 2027 is expected to vary from 35% of reasoning and decision-making to 65% of information and data processing.

But while expectations of the displacement of physical and manual work by machines has decreased, reasoning, communicating and coordinating – all traits with a comparative advantage for humans – are expected to be more automatable in the future. Artificial intelligence, a key driver of potential algorithmic displacement, is expected to be adopted by nearly 75% of surveyed companies and is expected to lead to high churn – with 50% of organizations expecting it to create job growth and 25% expecting it to create job losses.

The combination of macrotrends and technology adoption will drive specific areas of job growth and decline:

- ***The fastest-growing roles relative to their size today are driven by technology, digitalization and sustainability.*** The majority of the fastest growing roles are technology- related roles. AI and Machine Learning Specialists top the list of fast-growing jobs, followed by Sustainability Specialists, Business Intelligence Analysts and Information Security Analysts. Renewable Energy Engineers, and Solar Energy Installation and System Engineers are relatively fast-growing roles, as economies shift towards renewable energy.
- ***The fastest-declining roles relative to their size today are driven by technology and digitalization.*** The majority of fastest declining roles are clerical or secretarial roles, with Bank Tellers and Related Clerks, Postal Service Clerks, Cashiers and Ticket Clerks, and Data Entry Clerks expected to decline fastest.
- ***Large-scale job growth is expected in education, agriculture and digital commerce and trade.*** Jobs in the Education industry are expected to grow by about 10%, leading to 3 million additional jobs for Vocational Education Teachers and University and Higher education Teachers. Jobs for agricultural professionals, especially Agricultural Equipment Operators, are expected to see an increase of around 30%, leading to an additional 3 million jobs. Growth is forecast in approximately 4 million digitally- enabled roles, such as E-Commerce Specialists, Digital Transformation Specialists, and Digital Marketing and Strategy Specialists.
- ***The largest losses are expected in administrative roles and in traditional security, factory and commerce roles.*** Surveyed organizations predict 26 million fewer jobs by 2027 in Record-Keeping and Administrative roles, including Cashiers and Ticket Clerks; Data Entry, Accounting, Bookkeeping and Payroll Clerks; and Administrative and Executive Secretaries, driven mainly by digitalization and automation.
- ***Analytical thinking and creative thinking remain the most important skills for workers in 2023.*** Analytical thinking is considered a core skill by more companies than any other skill and constitutes, on average, 9% of the core skills reported by companies. Creative thinking, another cognitive skill, ranks second, ahead of three self-efficacy skills – resilience, flexibility and agility; motivation and self-awareness; and curiosity and lifelong learning – in recognition of the importance of workers ability to adapt to disrupted workplaces. Dependability and attention to detail, ranks sixth, behind technological literacy. The core skills top 10 is completed by two attitudes relating to working with others – empathy and active listening and leadership and social influence – as well as quality control.

Employers estimate that 44% of workers' skills will be disrupted in the next five years. Cognitive skills are reported to be growing in importance most quickly, reflecting the increasing importance of complex problem-solving in the workplace. Surveyed businesses report creative thinking to be growing in importance slightly more rapidly than analytical thinking. Technology literacy is the third-fastest growing core skill. Self-efficacy skills rank above working with others, in the rate of increase in importance of skills reported by businesses. The socio-emotional attitudes which businesses

consider to be growing in importance most quickly are curiosity and lifelong learning; resilience, flexibility and agility; and motivation and self-awareness. Systems thinking, AI and big data, talent management, and service orientation and customer service complete the top 10 growing skills. While respondents judged no skills to be in net decline, sizable minorities of companies judge reading, writing and mathematics; global citizenship; sensory-processing abilities; and manual dexterity, endurance and precision to be of declining importance for their workers.

Six in 10 workers will require training before 2027, but only half of workers are seen to have access to adequate training opportunities today. The highest priority for skills training from 2023-2027 is analytical thinking, which is set to account for 10% of training initiatives, on average. The second priority for workforce development is to promote creative thinking, which will be the subject of 8% of upskilling initiatives. Training workers to utilize AI and big data ranks third among company skills-training priorities in the next five years and will be prioritized by 42% of surveyed companies.

Employers also plan to focus on developing worker's skills in leadership and social influence (40% of companies); resilience, flexibility and agility (32%); and curiosity and lifelong learning (30%). Two-thirds of companies expect to see a return on investment on skills training within a year of the investment, whether in the form of enhanced cross-role mobility, increased worker satisfaction or enhanced worker productivity.

The skills that companies report to be increasing in importance the fastest are not always reflected in corporate upskilling strategies. Beyond the top-ranked cognitive skills are two skills which companies prioritize much more highly than would appear according to their current importance to their workforce: AI and big data as well as leadership and social influence. Companies rank AI and big data 12 places higher in their skills strategies than in their evaluation of core skills, and report that they will invest an estimated 9% of their reskilling efforts in it – a greater proportion than the more highly-ranked creative thinking, indicating that though AI and big data is part of fewer strategies, it tends to be a more important element when it is included.

Leadership and social influence ranks five places higher than suggested by its current importance and is the highest ranked attitude. Other skills which are strategically emphasized by business are design and user experience (nine places higher), environmental stewardship (10 places higher), marketing and media (six places higher) and networks and cybersecurity (five places higher).

Respondents express confidence in developing their existing workforce, however, they are less optimistic regarding the outlook for talent availability in the next five years. Accordingly, organizations identify skills gaps and an inability to attract talent as the key barriers preventing industry transformation. In response 48% of companies identify improving talent progression and promotion processes as a key business practice that can increase the availability of talent to their organization, ahead of offering higher wages (36%) and offering effective reskilling and upskilling (34%).

Surveyed companies report that investing in learning and on-the-job training and automating processes are the most common workforce strategies which will be adopted to deliver their organizations' business goals. Four in five respondents expect to implement these strategies in the next five years. Workforce development is most commonly considered to be the responsibility of workers and managers, with 27% of training expected to be furnished by on-the-job training and coaching, ahead of the 23% by internal training departments and the 16% by employer-sponsored apprenticeships. To close skills gaps, respondents expect to reject external training solutions in favour of company-led initiatives.

A majority of companies will prioritize women (79%), youth under 25 (68%) and those with disabilities (51%) as part of their DEI programmes. A minority will prioritize those from a disadvantaged religious, ethnic or racial background (39%), workers over age 55 (36%), those who identify as LGBTQI+ (35%) and those from a low- income background (33%).

Forty-five percent of businesses see funding for skills training as an effective intervention available to governments seeking to connect talent to employment. Funding for skills training ranks ahead of flexibility on hiring and firing practices (33%), tax and other incentives for companies to improve wages (33%), improvements to school systems (31%) and changes to immigration laws on foreign talent (28%). wn

Download the full report here.

Revitalising SA's Manufacturing Sector

a. Background

This report is the third in a series of research papers on the South African manufacturing sector that both highlight the sector's notable contribution to the South African economy and the need to effectively support the sector, so as to unlock the sector's potential and for it to meaningfully contribute to different aspects of the country's development. In addition, the reports make a case for the South African manufacturing sector, for the opportunities available for growth, and for its overall capacity to better compete in the global economy.

South Africa's manufacturing sector, similar to its global counter parts, is facing a host of new challenges on account of the implications of the ongoing Covid-19 pandemic – and this is over and above the pre-existing (i.e.: pre-pandemic) sectoral and macroeconomic policy handicaps the sector has to contend with. The growing concerns for environmental sustainability, the rising consumer awareness about the significance of reducing carbon footprint for all goods and services, and the escalation in the cost of energy in all its forms are but a few examples of the constraints within which global manufacturing needs to redefine its operations. In effect, a process of de-globalization is at play, in part driven by the recent and ongoing global supply chain disruptions highlighting the need for increased localization as a means of expansion, security and survival for certain industries. As a corollary, local procurement plays an important role in the local manufacturing sector, and done in the right manner, could help bolster the struggling sector in order for it to contribute more towards the country's sustainable growth.

To this end, it is critical that national and sectoral industrial strategies be based on two effective pillars. One is an appropriate competitiveness matrix – not simply price comparisons. Second, local procurement should be driven by an appropriate blend of value chain linkages, economics of agglomeration, and market-driven and efficient regulations. These themes will run through this report.

The previous two reports were entitled: **"MAPP: Revitalising SA's Manufacturing Sector" and "MAPP: Revitalising SA's Manufacturing Sector Part 2".** The first report underscored the changing structure of the South African economy as well as that of the manufacturing sector, the sector's export performance, contribution to employment, impact on government finances as well as the country's external accounts. It sought to quantify the importance of the sector in general, highlighting the multiplier effects that the sector has in the economy.

In the second report, the manufacturing sub-sectors of agro-processing and pharmaceuticals were identified by Proudly SA as some of the important drivers of sustainable growth, with high potential for expansion, given the right environment. Hence the study focused on the two sub-sectors and investigated their impact on the economy. Moreover, the work went further by looking at local procurement opportunities in the manufacturing sector as well as the two sub-sectors in particular. Similar to the first study, a Computable General Equilibrium (CGE) analysis of the manufacturing sector was carried out with the aim of investigating the multiplier effects that the sector has on the various economic variables deemed important to the country's socio-economic well-being.

b. Objectives of the Study

Serving as both an update and an extension to the work done in the previous two reports, the objective of this study is to analyse the South African manufacturing sector once again, and most importantly, quantify its contribution to the wider economy. The study investigates the multiplier effects manufacturing has on the country's growth, exports, job creation and fiscal revenue generation. It goes further in this by doing an analysis, including multiplier effects of the key industries of (i) agro-processing (ii) meat (iii) sugar (iv) furniture (v) automotive (vi) steel, and (vii) pharmaceuticals, on the country's macroeconomic variables. Finally, the study examines policies and other forms of sector support in manufacturing, including localization and local procurement, meant to assist the sector.

An investigation into the potential impact of injections into the manufacturing sector on the economy has increasingly become important given the deteriorating state of the economy, the structural nature of the country's labour force, wide-spread poverty and dire employment prospects. This is, moreover, in the context of the ongoing Covid-19 pandemic and the recent negative turn in the geopolitical sphere (i.e.: the Ukraine-Russian war). But as significant an impact these phenomena (particularly the pandemic) have had on manufacturing, the sector, like the rest of the South African economy, has been languishing under years of structural impediments that have stifled its optimal growth. It is hoped this, most recent analysis of South Africa's manufacturing sector and the respective sub-sectors will highlight the opportunities that provide real potential in boosting these industries to benefit the economy.

The study consists of a blend of descriptive statistical analysis and quantitative computations based primarily on both a social accounting model (SAM) and a computable general equilibrium (CGE) model of the South African economy. **Section II** provides an analysis of the Manufacturing sector within the context of the South African economy, reviewing the dominant trends in the sector. **Section III** critically examines the contemporary and current public policies and proposals aiming at the promotion of manufacturing activity in the country.

Section IV quantifies the technical and systemic linkages between the above mentioned seven key sub-sector industries and the broader economy. To this end, the manufacturing sector and sub-sectors' SAM and CGE model analysis are carried out with the aim of investigating the multiplier effects that the industry has on the country's growth, job creation, balance of payments and fiscal revenue generation. Such quantitative analyses help guide the relative impact that various policy options could entail. To the extent that the economic structure continues to change in response to the ongoing technological innovations and global business environment, such multipliers require regular updating as policies need technical review and impact analysis.

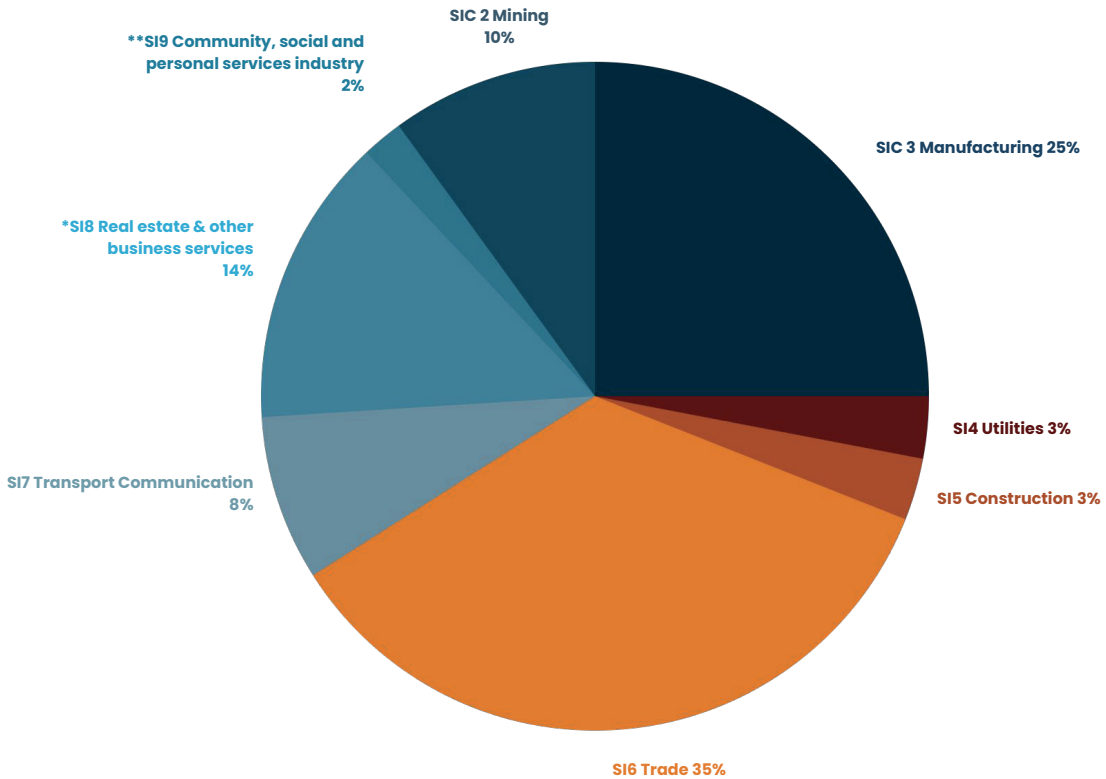
02 THE MANUFACTURING SECTOR AND THE SOUTH AFRICAN ECONOMY

a. The South African Manufacturing Sector

Manufacturing has historically been credited for being a key driver of higher value job creation and for the increase in living standards. The sector has indeed been vital to the South African economy and there are a myriad of reasons why it continues to be important. First and foremost, manufacturing contributes significantly towards the country's gross domestic product (GDP) – in 2021, the sector contributed 13%[1] towards GDP with a gross value added (GVA) of R523 billion. Additionally, the sector has one of the highest total turnovers by industry as depicted in Figure 1. The 2021 GVA, although an increase from 2020's low of R490 billion, was still significantly lower than the pre-pandemic GVA, i.e.: 2019's GVA of R559 billion. Relative to the performance of the sector in previous years, the 2021 manufacturing GVA was only closer to 2010's GVA of R525 billion. This, of course, mostly highlights the material impact, the Covid-19 induced economic crisis has had and continues to have on the manufacturing sector.

[1] *Own calculation from Stats SA data*

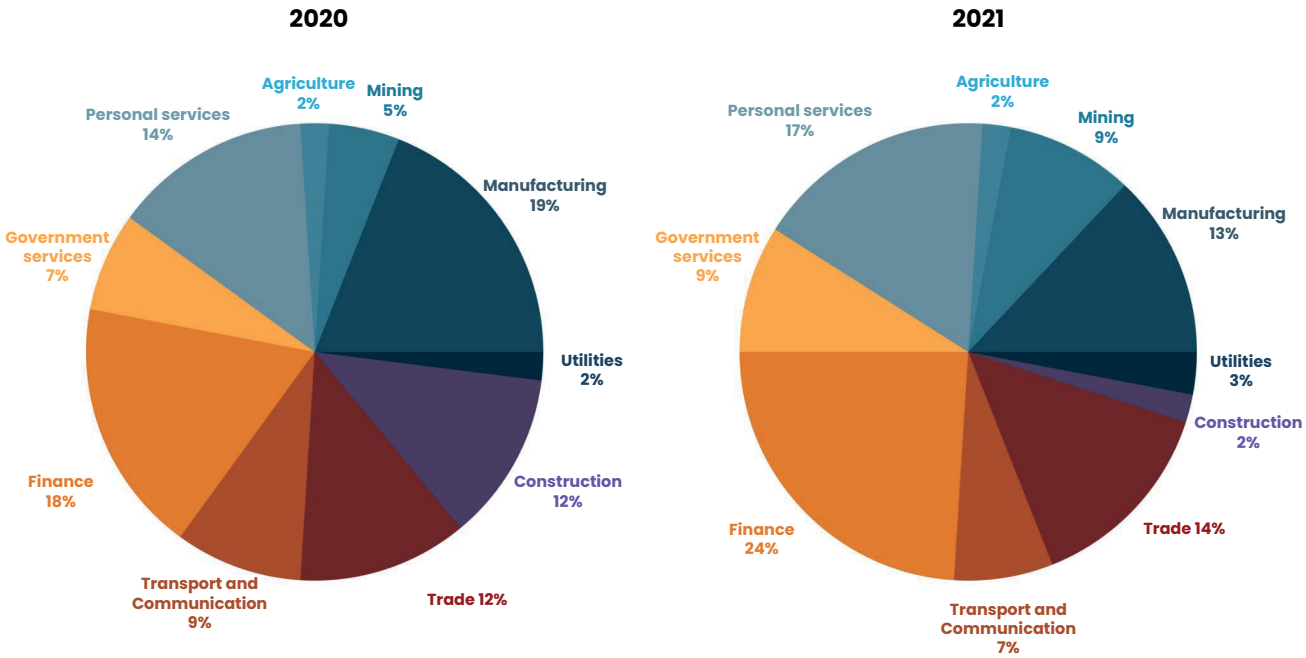
Figure 1: Percentage contribution to total turnover by sector, Q4-2021



Source: Stats SA data and PAIRS
Note: *excluding financial intermediation and insurance
** excluding government and educational institutions

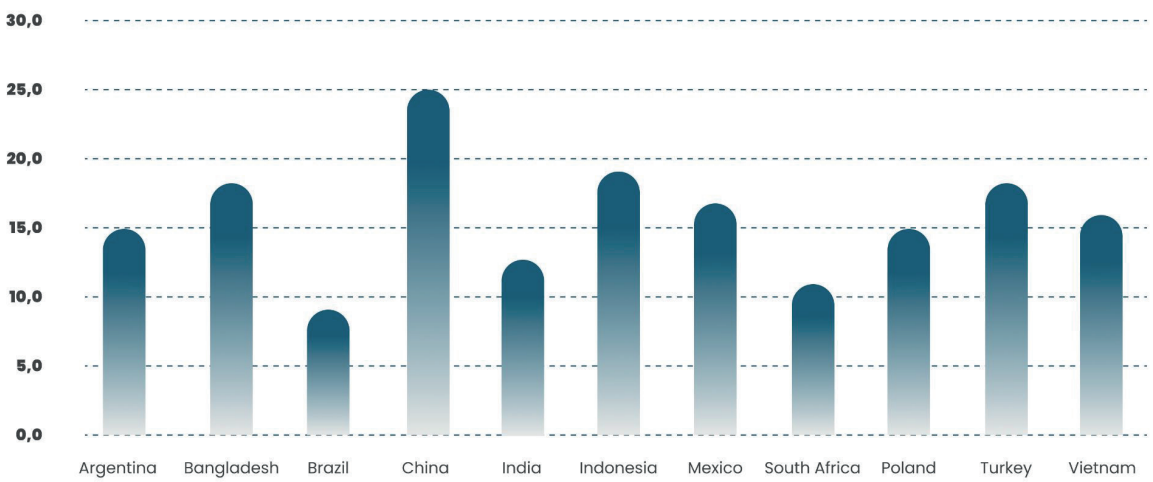
Recent exceptional dynamics brought on by the pandemic aside, South Africa's manufacturing sector as a share of the whole economy has declined significantly since its peak in the early 1980s, as discussed in the first report (2016). Empirical evidence demonstrates that as countries develop, the gradual decline of manufacturing sectors as a share of economies is the norm ('de-industrialisation'). However, the decline of the manufacturing sector in South Africa has been exceptionally accelerated, especially relative to its emerging market peers. Rodrik (2006) argues that the country's manufacturing has failed to keep up with those of other emerging countries such as China and Bangladesh. Figure 3 below provides manufacturing GVA as a share of GDP for a selected number of emerging market economies, and it indeed shows South Africa's GVA being relatively low compared to the other emerging market economies.

Figure 2: The Evolving Composition of the South African Economy, 2000 and 2021



Source: Own calculations, Stats SA (2022)

Figure 3: Manufacturing Value Added (% of GDP) for Selected Emerging Market Economies (2020)

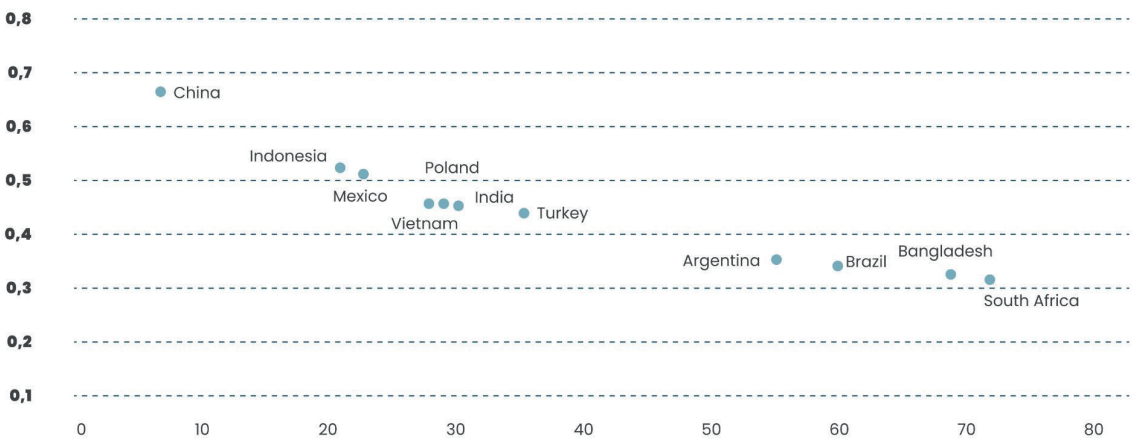


Source: World Bank data and PAIRS

Competitively, the South African manufacturing sector continues to lag those of its emerging market counterparts, hence its inability to 'keep up'. This is particularly demonstrated by the United Nations Industrial Development Organisation's (UNIDO) industrialisation intensity index as depicted in Figure 4 below.

The index is measured by taking the average of two measures: the share of manufacturing value added (MVA) in GDP and the share of medium-and-high-technology (MHT) activities in MVA. In turn, MVA (see Figure 3 above) captures the role of manufacturing in the economy, while MHT captures the technological complexity of manufacturing. South Africa had the lowest score[2] of the selected emerging market countries, causing it to rank lowest (72 out of a total of 152 countries) due to having both low MVA (Figure 3) and low technological complexity in manufacturing. It is a fact that manufacturing paradigms globally are rapidly evolving because of fast changing technologies, and the South African manufacturing sector needs to keep up in order to remain competitive.

Figure 4: Industrialisation Intensity Index for Selected Emerging Market Economies, 2020



Source: UNIDO data and PAIRS

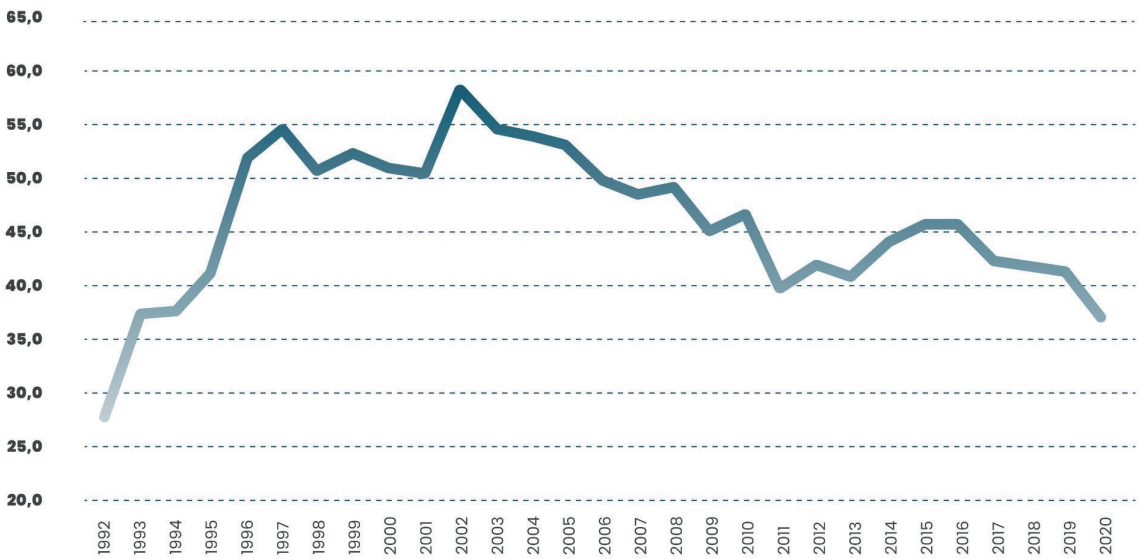
(i) Exports Competitiveness

Globally, manufacturing sector exports make up 70% of total merchandise exports as per 2020 data by the World Bank[3]. This value is even higher for key manufacturing economies such as China (94%) and averages 74% for upper-middle income countries of which South Africa is part of[4]. The latest available global exports data (2020) indicates that, of merchandise goods exported by South Africa, only 38% were manufactured goods. Since peaking two decades ago in 2002, the country's manufactured goods as a ratio of total merchandise exports have been on a downward trend as can be seen in Figure 5 below. In addition, South Africa's export values have generally been lagging those of the country's peers (see Figure 6 below), many of which have experienced impressive growth over the past two decades.

2 *2020 industrialisation intensity index*
3 *World Bank World Development Indicators, May 2022*
4 *Per World Bank classifications*

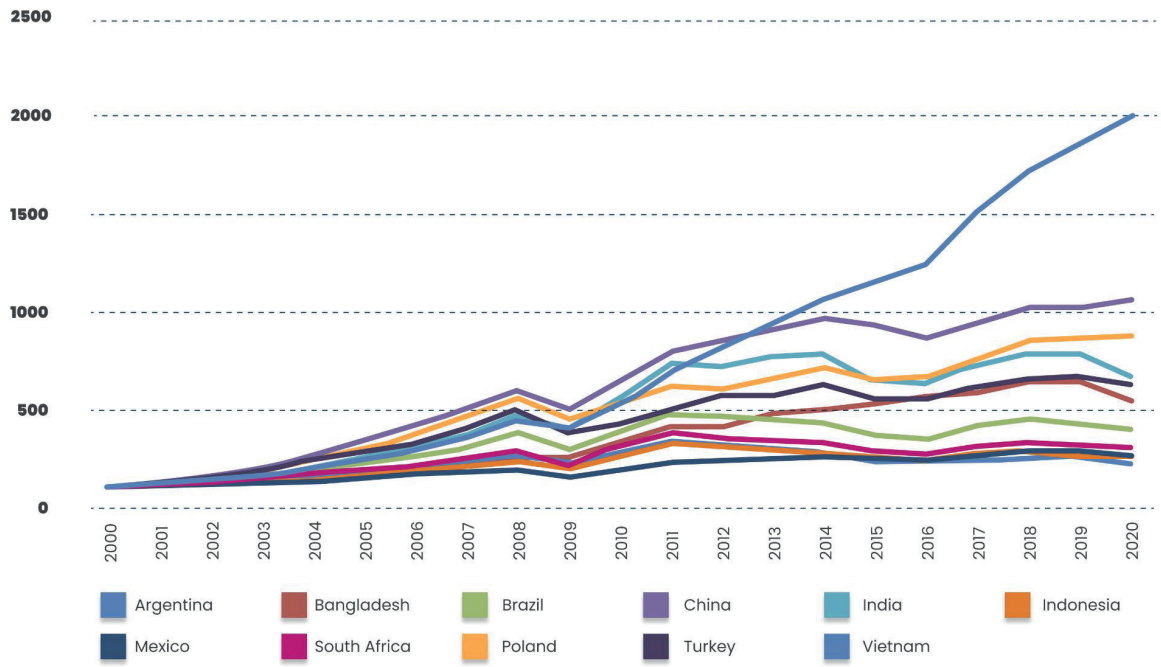
Again, this phenomenon can largely be ascribed to South Africa's lack of manufacturing competitiveness. Unlike its peers that have benefited from sound industrial policies and other forms of sector support, the country's domestic sector has largely been left unsupported. The exception in this case has mainly been the automotive industry (which is aided through the Automotive Production and Development Program, formerly the Motor Industry Development Program).

Figure 5: South African Manufactured Exports (% of Merchandise Exports)



Source: World Bank and PAIRS

Figure 6: Export Value Index (2000 = 100) for Selected Emerging Market Economies

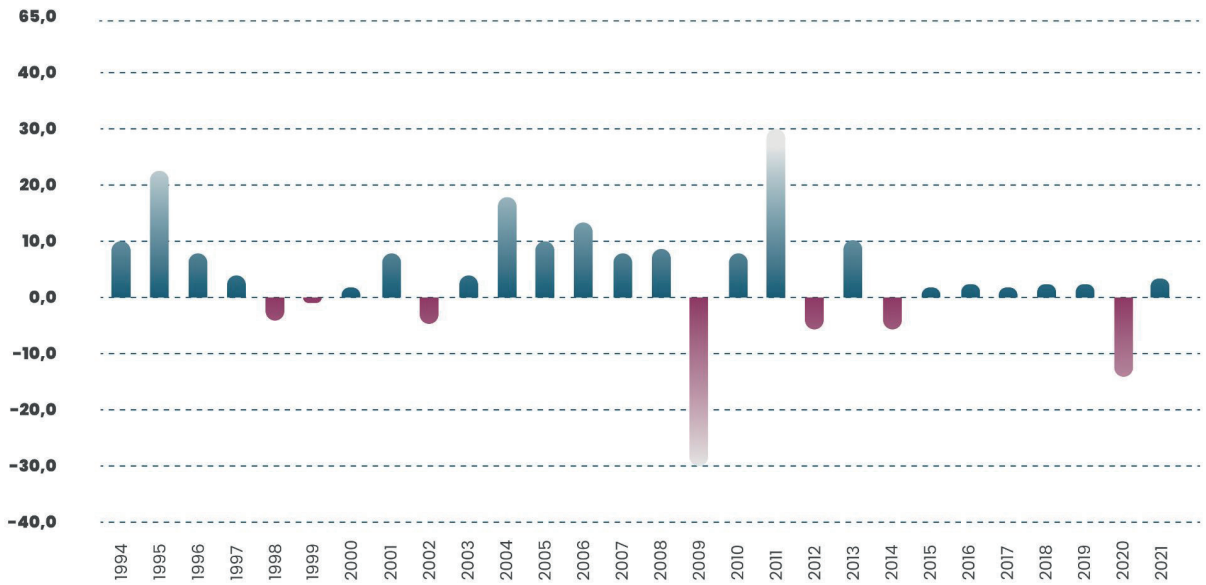


Source: World Bank and PAIRS

(ii) Investment in Manufacturing

Sufficient investment in any sector, including manufacturing, is a necessity for sustainable growth and development. Gross fixed capital formation has shown to be an important driver of economic growth in South Africa. By means of illustration, research by Perkins, Fedderke and Luiz (2005) finds there to be a long-run causal relationship running from investment in economic infrastructure, to stock of fixed capital to gross domestic product. South Africa's gross fixed capital formation in manufacturing totalled R87.7 billion in 2021, a slight recovery from its steep decline to R85.5 billion during 2020, but still significantly less than that of R98.7 billion registered in 2019. Overall, annual growth in manufacturing gross fixed capital formation averaged only 1.6 percent during the five years before the Covid-19 pandemic (see Figure 7 below). The low levels of gross fixed capital formation in manufacturing are hence leading to low levels of growth in manufacturing value added.

Figure 7: Real Annual Growth in Manufacturing Gross Fixed Capital Formation



Source: Stats SA data and PAIRS

(iii) Employment and the Manufacturing Sector

The National Development Plan (NDP) 2030 (the NDP was launched in 2012), a policy document with great ambitions on inclusive economic growth and job creation has so far fallen extremely short of its targets. It had plans of expanding manufacturing jobs by close to a million over a 20-year period. Manufacturing jobs, along with those in other sectors, have however, plummeted and the unemployment rate is currently at a staggering 34.3%[5]. As the share of manufacturing in the economy declines in the South African economy as already demonstrated in Figure 2, so too has the sector's overall contribution towards employment creation. Figure 8 below shows that, after peaking more than 3 decades ago, employment in manufacturing has been declining notably over the years. In addition, manufacturing shed a significant number of jobs on account of the Covid-19 pandemic. In 2019, i.e.: before the pandemic, an average of 1.8 million individuals were employed in the manufacturing sector, but this number had dwindled to an average of only 1.4 million in 2021.

The latest data from Statistics South Africa (Stats SA) shows that although manufacturing made up 13.5% of the economy in terms of sector share of nominal GDP during Q4-2021, manufacturing only contributed 9.1% towards total employment in the country. Figure 9 also demonstrates that even during those periods when manufacturing value added was

[5] *For 2021*

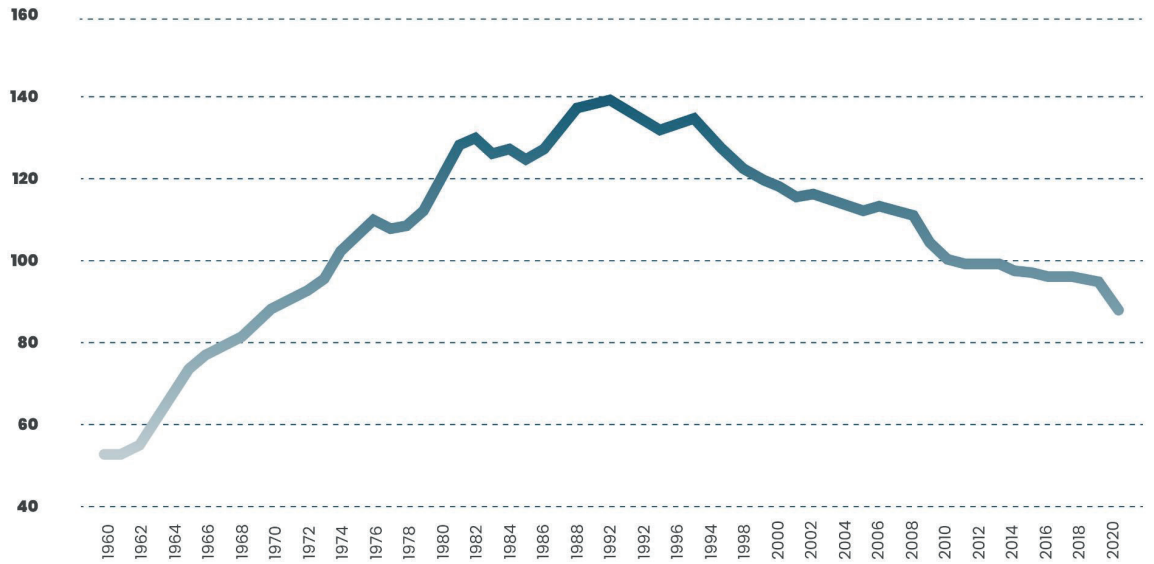
increasing, employment in manufacturing (as captured by the index of employment in manufacturing) was still deteriorating.

On the other hand, although the common argument is that South Africa's manufacturing sector is largely capital intensive as opposed to being labour intensive, evidence also signals to the country's manufacturing processes to be relatively lower in technology intensity. South Africa's share of medium-and-high-technology (MHT) activities in manufacturing value added is comparatively low and places the country at 68 out of 152 countries in the UNIDO 2020 Competitive Industrial Performance (CIP) report. This is much lower than emerging market peers such as India, China, Indonesia and Turkey, with MHT ranking of 28, 29, 44 and 50, respectively. These countries' manufacturing sectors still employ similar or more individuals as a ratio of total employment. As a share of total employment, the manufacturing sectors of India, China, Indonesia and Turkey employed 25%, 27%, 22%, 25% of workers respectively in 2019 according to World Bank data[6] relative to South Africa's 22%.

There are different means through which South Africa's manufacturing sector can contribute more towards employment creation depending on the type of manufacturing, i.e.: the level of capital and labour intensity. A study by Zalk (2014) points out that, for those sectors that are highly capital intensive, employment is largely created via the enablement of greater employment in other sectors. These other sectors are both medium and highly labour intensive through the provision of intermediate inputs at competitive prices. For those manufacturing sub-sectors in which capital and labour are complementary (e.g.: components for renewable energy sector), employment rises alongside capital investment. Lastly, for those manufacturing sub-sectors that are inherently labour intensive, there are ways to improve South Africa's competitiveness such as through the improvement of product quality and better industrial planning (e.g.: locating light industry closer to affordable housing). This then suggests that it is possible to improve different facets of the country's manufacturing sectors' abilities to better contribute towards employment by making use of the right policies and appropriate interventions.

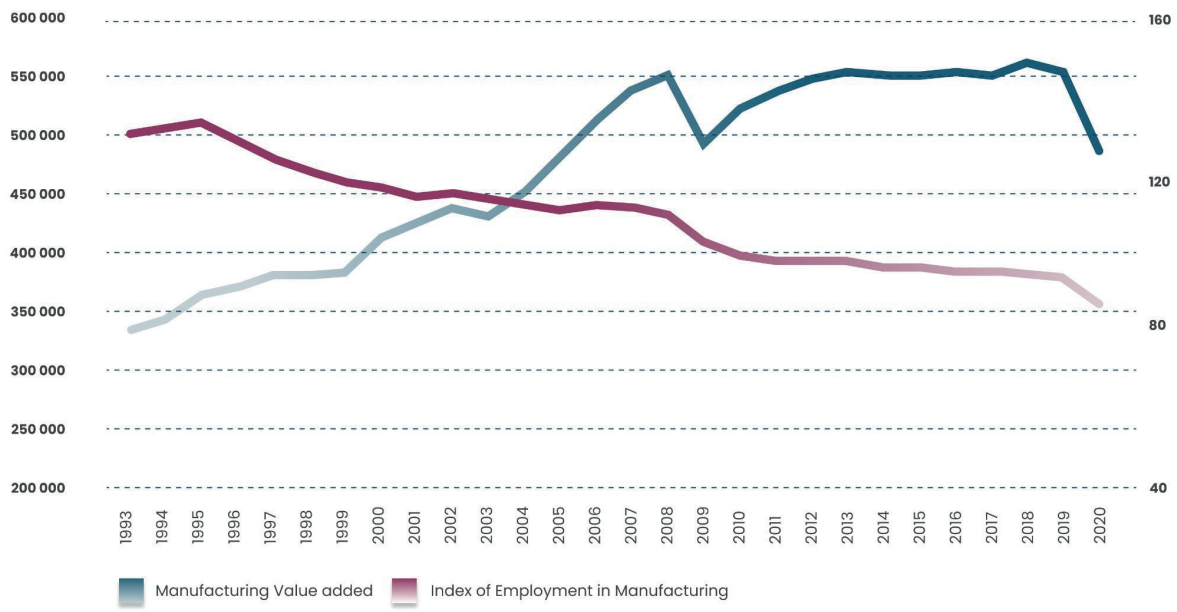
6 *World bank Indicators, May 2022*

Figure 8: Index of Employment in the Manufacturing Sector (2010 = 100)



Source: SARS and PAIRS

Figure 9: Manufacturing Value Added and Employment in Manufacturing, 1993 – 2020



Source: Stats SA, SARB and PAIRS
Note: MVA = constant 2015 prices
Manufacturing Employment Index, 2010 = 100

(iv) The Manufacturing Sector and the Fiscus

A critical impact of the ongoing de-industrialisation in South Africa is the rapidly declining number of taxpayers in the manufacturing sector, with negative implications for government revenue base. Table 1 illustrates the number of both taxpayers and tax assessed for the manufacturing sector from 2017 to 2020. It shows that although the number of tax payers in manufacturing had reached 71 304 in 2017, they declined by 3.6% as this number moderated to 68 760 in 2019 (i.e.: pre-pandemic), while the tax assessed also declined by 17.8% in nominal terms as it dropped from R35.3 billion to R29 billion during the period. The decline of both the number of taxpayers and tax assessed was steeper in 2020 on the back of the Covid-19 pandemic induced economic crisis. These trends do not bode well for the fiscus and economy as a whole and have grave negative macroeconomic consequences. The Covid-19 pandemic had a profoundly negative impact on the South African fiscus (a fiscus that was already weakened), and it is vital that the manufacturing sector's significant contribution towards government finances not only recovers but also expands.

Table 1: Manufacturing Sector Tax Assessed, 2017 – 2020

Tax Year	2017 (*100.2% assessed tax as % of provisional tax)*		2018 *(95.0% assessed tax as % of provisional tax)*		2019 *(93.4% assessed tax as % of provisional tax)*		2020 *(61.3% assessed tax as % of provisional tax)*	
Economic activity	Number of taxpayers	Tax assessed (R million)	Number of taxpayers	Tax assessed (R million)	Number of taxpayers	Tax assessed (R million)	Number of taxpayers	Tax assessed (R million)
Manufacturing*	71 403	35 325	68 369	33 203	68 760	28 990	61 559	16 487
% of total	7.3%	16.7%	7.6%	16%	8.5%	14.2%	8.7%	13.2%

Source: SARS data
Note: Includes the following SARS sectors – Bricks, ceramic, glass, cement and similar products; Chemicals and chemical, rubber and plastic products; Clothing and footwear; Coal and petroleum products; Food, drink and tobacco; Leather, leather goods and fur (excl. footwear & clothing); Machinery and related items; Metal (including metal products); Other manufacturing industries; Paper, printing and publishing; Scientific, optical and similar equipment; Textiles; Transport equipment; and Wood, wood products and furniture.

The rapid decline of South Africa's manufacturing sector is of particular concern then, as evidence from other fast growing emerging countries having been able to lift millions of people out of poverty in just a few decades (such as China) shows that they achieved this due to their robust manufacturing sectors. It is argued by Bhorat and Rooney (2017) that history shows those countries that transitioned from middle-income[7] to high-income did so on the

[7] *South Africa is an upper-middle income country according to World Bank classifications*

back of healthy manufacturing sectors. Zalk (2014) likewise highlights the work of the World Bank's Commission on Growth and Development (as captured in the 2008 report) in this regard. It shows 10 out of 13 countries (including Japan, Brazil, China, Indonesia and Malaysia) that were identified as having experienced 'episodes of high and sustained growth', i.e.: GDP per capita exceeding 7% per annum for 25 years and more, had growths that was led by their manufacturing sectors.

b. Challenges Facing the South African Manufacturing Sector

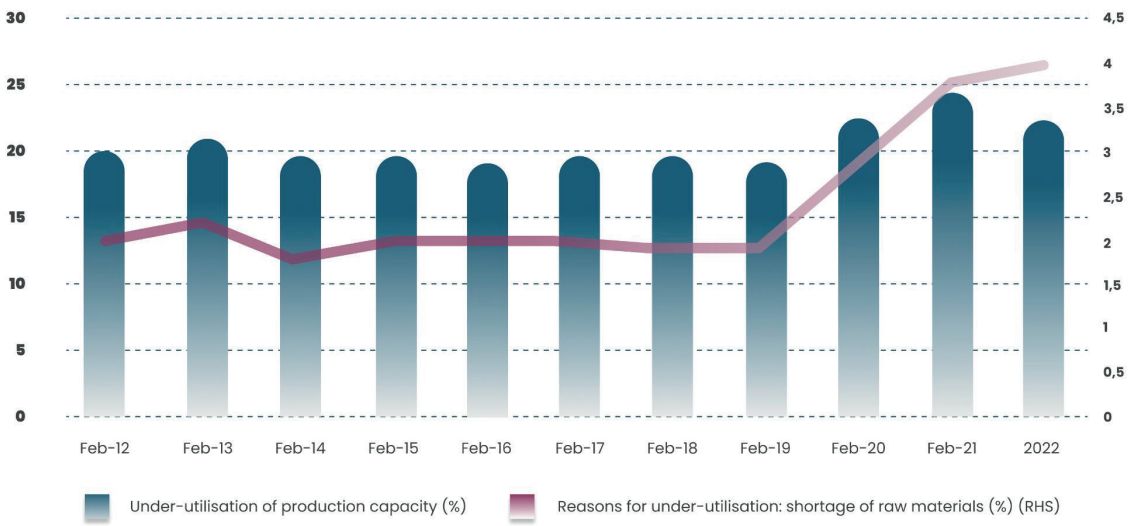
The South African manufacturing sector continues to be inhibited by a myriad of factors that prevent it from performing at its peak. Consequently, manufacturing's ability to contribute towards economic growth, employment, export and tax revenue is compromised. These elements include both supply and demand side factors, which were discussed extensively in the first two reports: "MAPP: Revitalising SA's Manufacturing Sector" and "MAPP: Revitalising SA's Manufacturing Sector Part 2". Both the supply-side and demand-side impediments faced by the country's manufacturers, including new emerging challenges, are highlighted below.

(i) Supply-Side Constraints

The Covid-19 pandemic triggered historic global supply chain disruptions that are still unfolding. These largely came on the back of lockdown restriction meant to curb the spread of the Covid-19 pandemic and the surge in demand as economies recovered from the Covid-19 induced recession, which then resulted in demand outpacing supply. The South African manufacturing sector too, continues to be adversely impacted by supply chain bottlenecks and shortages of raw material. For example, the ongoing shortage of microchips has had a negative impact on the domestic production of motor vehicles.

By means of illustration, not only has the South African manufacturing sector's utilisation of capacity been materially undermined since the beginning of the Covid-19 pandemic, but raw material shortages have also become increasingly prevalent. Figure 10 below provides the sector's ratio of under-utilisation of production capacity, together with the "shortage of raw materials" as the reason for the under-utilisation of capacity. Not only does the data show the under-utilisation of capacity increasing significantly since 2020, but there was a steep rise in "shortage of raw material" given as the reason for the under-utilisation.

Figure 10: Under-Utilisation of Production Capacity in South African Manufacturing



Source: Stats SA data and PAIRS
Note: Data is for the month of February

Other key supply-side constraints facing the South African Manufacturing Sector include:

a. inadequate infrastructure such as energy, water, transportation, and export logistics
b. high transport costs;
c. high unit labour costs that are also rising faster than labour productivity;
d. skills shortages;
e. high energy costs, especially the escalating electricity prices;
f. mismatch between South Africa's factor endowment and manufacturing output; and
g. the growing threat of cyber-attacks.

(ii) Demand-Side Constraints

Global demand, alongside overall global economic recovery from the Covid-19 pandemic induced recession, is currently under threat from three main factors. The first one is the heightened inflation rates globally. One of the leading complications brought on by the accelerating inflation rates has been the generally faster than initially anticipated monetary policy normalization, leading to tighter global financial conditions. At the same time, the higher inflation rates are having a detrimental impact on consumers. The sum total of these complex macroeconomic and financial variables is an overall contraction in economic activity, job creation and households' income. Meanwhile, rising Covid-19 cases in Asia, which have particularly induced harsh lockdowns in China, pose another risk to global growth and demand.

Finally, the ongoing Ukraine-Russia war presents another major threat to the global economy and therefore on demand for South African exports, while at the same time exacerbating the upward pressures on inflation mainly on account of its impact on commodity prices, especially oil and food prices.

Other key demand-side constraints facing the SA manufacturing sector are:

a. unfavourable public policy and lack of assistance for the majority of the country's industries, especially relative to South Africa's peer countries;
b. volatile exchange rate;
c. exports not being the main business focus of the majority of South African manufacturers;
d. relatively low total factor productivity (TFP); and
e. deteriorating competitiveness due to, inter alia, infrastructure and logistical bottlenecks.

(iii) Environmental Factors

Finally, as the world in which the manufacturing sector evolves, manufacturers and policy makers must adjust the way the sector operates in order to not only keep up with global trends but also to thrive amid the changes. A case in point is the increasing movement towards more environmentally sustainable practices in business including that of manufacturing. This is because, as put in a report by McKinsey (2020) on the need to reimagine industrial operations, even though the industrial revolution and large-scale operations have raised the standards of living globally, one of its major unintended consequences has been wide scale pollution.

At the same time, it has become advantageous for companies to adapt their operations in becoming more environmentally sustainable as they appreciate the substantial financial and environmental benefits associated with sustainable business practices. Therefore, several environmental "megaforces" will be central for the evolution in business practices in the coming years (EPA, 2022 and KPMG International, 2012). As climate change and other effects of pollution intensify, the implications for manufacturing will become vast, especially if it results in the diversion of resources. Consequently, manufacturers will need to invest in the development of particularly efficient processes and products, while at the same time managing for potentially unpredictable risks to supply chains (Foresight, 2013). Box 1 below provides some of the motives for companies to pursue sustainability as provided by the US Environmental Protection Agency (EPA, 2022), and these are amongst the numerous reasons, the South African manufacturing sector needs to adapt their operations.

Box 1: Reasons Companies Pursue Sustainability
i. To increase operational efficiency by reducing costs and waste
ii. To respond to or reach new customers and increase competitive advantage
iii. To protect and strengthen brand and reputation and build public trust
iv. To build long-term business viability and success
v. To respond to regulatory constraints and opportunities

Source: US EPA, https://www.epa.gov/sustainability/sustainable-manufacturing

c. Key Manufacturing Sub-Sectors

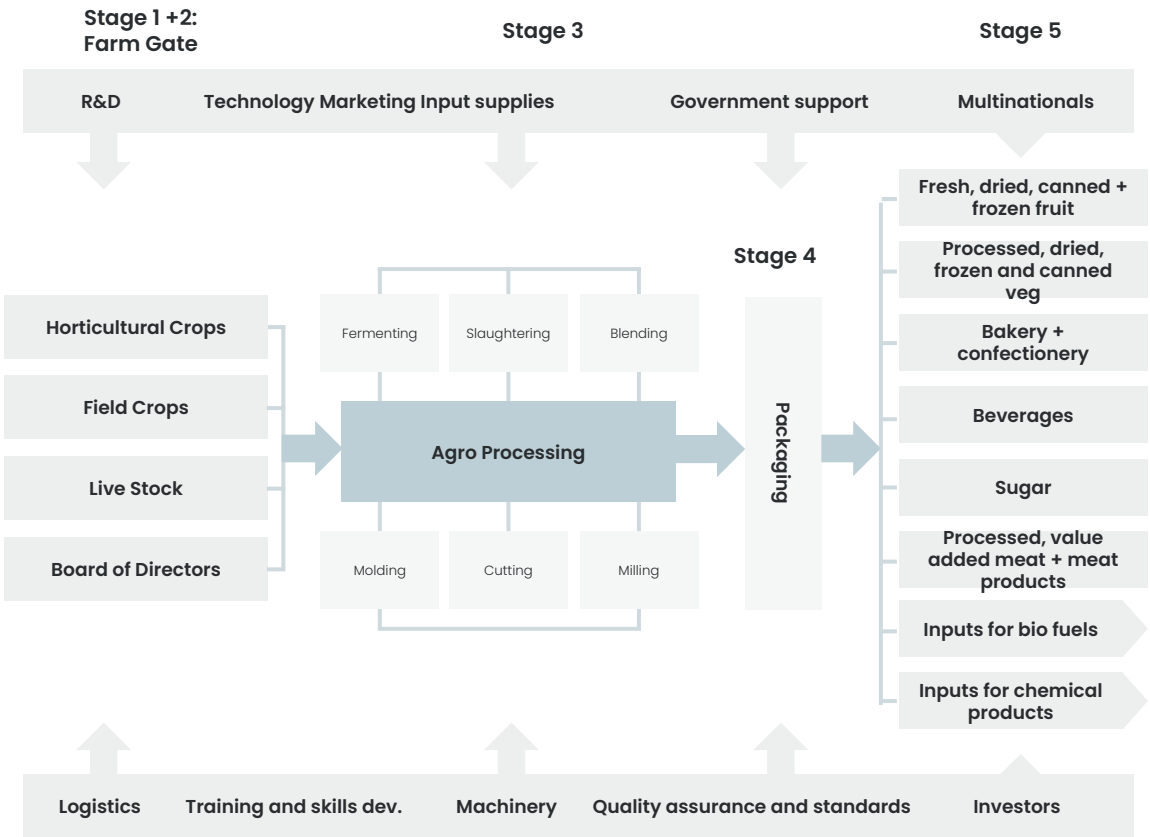
(i) Agro-Processing

Agro-processing has been identified as one of the crucial economic sectors that can lead to a transformation in the economy through sustainable employment creation, business investment opportunities, and growing the country's export base. This sub-sector of manufacturing beneficiates primary materials and intermediate goods from the agricultural, fisheries and forestry-based sectors. In other words, the sector has a firm backward linkage with the primary sectors and forward linkages with the secondary as well as tertiary sectors of the economy. As such, to drive aggregate growth, the best development path lies in selecting those activities where expansion will induce further progress in other industries[8]. In addition, this sub-sector consists of industries[9] that are believed to have the potential to make a significant contribution to the economic and social transformation of the country, as they are relatively labour intensive. This is undeniably an important factor for job creation and therefore makes the sector a possible vehicle for potential job creation.

[8] *FAO. (1997). The state of food and agriculture. FAO Agriculture Series No. 30. cited in Owoo, N.S, (2022). The Agro-Processing Industry and its Potential for Structural Transformation of the Ghanaian Economy. DOI:10.1093/oso/9780198821885.003.0010.*

[9] *Agro processing is a widely diverse sub-sector and is vital to the production of food products as well as the processing of wood for furniture and paper products.*

Figure 11: Agro-processing Value Chain



Source: Um Jwali Market Research

Figure 11 above suggests agro-processing has a huge potential for integrating SMMEs to operate[10] through all the stages of the value chain. However, there are numerous barriers to entry that constrain the penetration and participation of SMMEs agro-processors in the mainstream economy. To remedy this, the Department of Agriculture, Land Reform and Rural Development (DALRRD) has developed policies, strategies, and programmes to improve SMMEs participation. Additionally, the Agriculture and Agro-Processing Master Plan, which was ratified in early May 2022, has identified areas of focus within the sub-sector to enhance inclusive growth and boost employment opportunities in rural South Africa for the agriculture sector. This indeed is a welcomed affirmation for both the sectors as vital in the South African economy and should in the long run contribute to food security, poverty alleviation and job creation.

[10] *SMMEs can be setup in phase 1 and 2 as suppliers of inputs, tools and fertilisers to the primary sector. In phase 3 for actual processing/manufacturing of raw materials, in phase 4 for the packaging of processed products. Finally, SMMEs in the manufacturing sector could also be consumers of the processed products as inputs into other manufacturing activities such as Bakery use of flour, sugar, milk etc.*

In terms of performance, the agro-processing industry had a share of approximately 5% in total gross value added in 2021. Additionally, the "food, beverages and tobacco" division contributed the most towards the agro-processing industry (just over 40%), followed by the "wood and wood products" division (just over 15%). However, in relation to employment in the manufacturing sector, about 38.1% is attributed to the agro-processing industry (Statistics South Africa, 2021). Furthermore, examination of the trade balance of the agro-processing industry shows that the sector was a net importer between 2015-2021, with imports recording a value of R566 billion compared to the export value of R365 billion in 2021. Despite this, the sector was a net exporter of two divisions in 2021 ("food, beverages, and tobacco products" and "furniture and other items n.e.c and recycling").

Around R400 million of the committed R1 billion grants to the Agri-Industrial Fund[11] has been transferred and similarly, around nine projects to date that are black owned and operated (four of these being owned by women) have been funded. In addition, there are 31 transactions still in the pipeline that are expected to create around 1 371 new permanent jobs. However, factors such as trade, logistics & supply disruptions as well as rising production costs, pose a risk for the agro-processing sector that is intertwined with the agricultural sector.

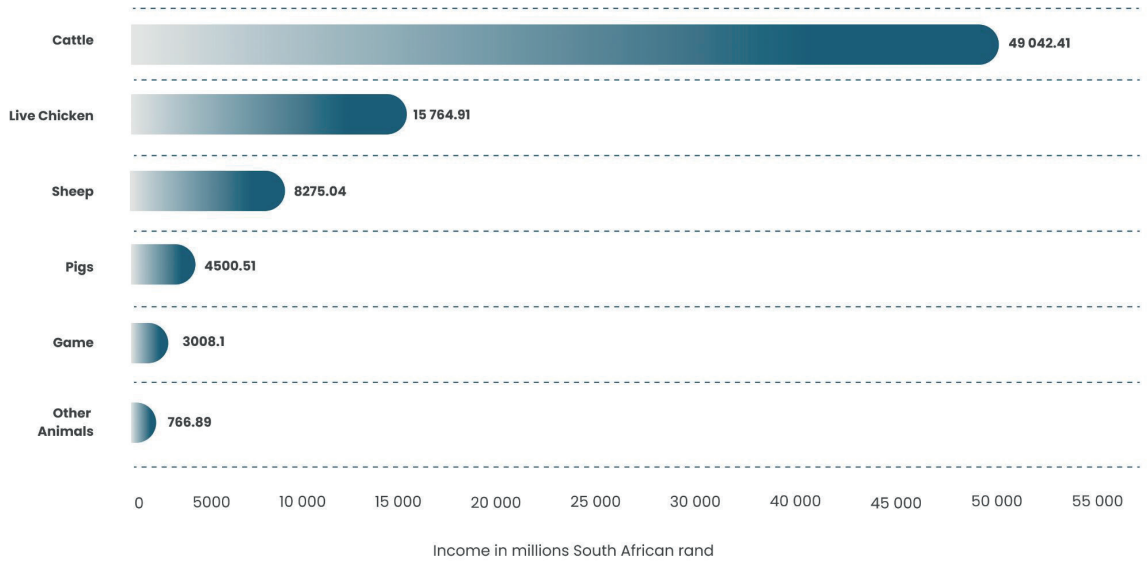
(ii) Meat

Since its outbreak, the Covid-19 pandemic has put a strain across the food manufacturing sector as a whole. The sector, when disaggregated, consists of six divisions with "meat and meat products" making up one of the largest sub-sectors in terms of output. Hence the direct and indirect negative impact on overall meat production was anticipated, as some meat plants were shut down. This led to not only a decline in production, but also in processing, distribution, and marketing potential. The volume of production of the "meat, fish, fruit, etc." division has remained positive since the beginning of 2022 (2% year-on-year, 4.6% year-on-year and 1.7% year-on-year in January, February and March 2022, respectively). That same category employed around 60 000 people with gross earnings of approximately R2.3 billion in the fourth quarter of 2021.

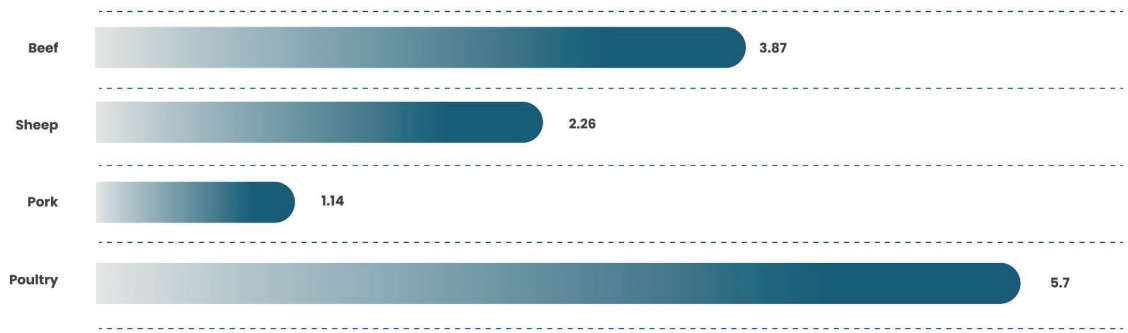
[11] *The Industrial Development Corporation (IDC) in partnership with the Department of Agriculture, Land Reform & Rural Development (DALRRD) have established the AGRI-INDUSTRIAL FUND, to support a wide range of economically viable activities in agro-processing (food and non-food) sectors. The aim is to develop a competitive industry in the food, beverage, fibre, forestry, and agro-derivative industries that utilises and develops local and regional resources to supply domestic demand and increase participation in international trade.*

Figure 12: Total Income (sales) from animals and Average per capita consumption of processed meat, 2020 (by type)

Total income from animals in the agriculture and related services industry in South Africa in 2020, by type (million SA rand)



Average per capita consumption of meat in South Africa 2020 (kilograms)



Source: Stats SA and OECD, FAO (in Mordor Intelligence)

In South Africa, poultry is the most preferred type of processed meat. Figure 12 above shows that poultry[12] was the most consumed meat (per person) in 2020, with sales of live chicken totalling R15.8 billion in that same year. Additionally, processed poultry accounts for around 40% of market share, making poultry the largest segment in the processed meat industry. Looking at chickens raised for meat production (broilers), a small group of large firms dominate in the country. This is because of the high degree of vertical integration and the high capital requirements needed to achieve sufficient economies of scale to compete successfully in the market for a highly tradable generic good.

[12] *Chicken meat is widely consumed and accounts for 65% of the market share, South Africa Processed Meat Market – Growth, Trends, Covid-19 Impact, and Forecasts (2022 – 2027)*

The poultry industry provides around 65 percent of locally produced animal protein consumed in the country (excluding milk), therefore dominating the animal products sector. Regarding exporting and importing of the commodity, the sector has recorded trade surpluses from 2017 to 2019, with a trade deficit recorded in 2020 when exports came in lower than imports. It is interesting to note that while South Africa generally has a surplus of chickens, Europe usually has a shortage of the product, which means South Africa can capitalize on this shortage and grow its exports as Europe is willing to pay for them. At the same time, South Africa has a duty-free status in the European Union (EU), meaning South African products don't attract duties when sold in the EU. However, the South African Association of Meat Importers and Exporters (AMEISA)[13] points out that because the country does not meet the health and safety standards required by trade blocs such as the EU, it will miss this great opportunity.

The recently ratified Poultry Master Plan aims to identify and address cross-cutting bottlenecks, industrial financing, export promotion, standards (including sanitary and phytosanitary requirements), innovation and technology, packaging, and skills. Additionally, there is also a potential to expand the industry across the value chain[14] if a substantial export market can be developed. The expansion would lead to increases in fixed investment, employment, and the value of output. Chicken producers committed to R1.5 billion in fresh funding within the next four years towards the investment drive. This is expected to result in nearly 4 000 additional jobs in the production of chicken. Moreover, barriers to entry into the poultry industry are reasonably low, which allows emerging farmers and small-scale participants and local economies to easily supplement industrial scale activity.

Without disregarding all efforts made in the poultry industry, rising imports of cheaper products will continue to present a challenge for poultry producers. At the end of 2021, government imposed provisional anti-dumping duties against bone-in chicken meat imports from Brazil and several EU countries to curb detrimental imports. This was however not enough. Investigations showed that dumping by Germany, the Netherlands and the UK continued. The International Trade Administration Commission of South Africa (Itac) therefore, recommended a five-year extension of existing anti-dumping duties on bone-in imports from these countries. This renewal should benefit the South African poultry industry, thus encouraging economic growth and job creation in the country.

13 *AMIE CEO, Paul Matthew, during the AMIESA media briefing, 26 May 2022.*

14 *The industry can be expanded by increasing capacity at all stages of the value chain: manufacturing of feed, farming of chickens and processing of poultry product.*

(iii) Sugar

The South African sugar industry is a combination of agricultural activities of sugar cane cultivation with the manufacture of raw and refined sugar, syrups and specialised sugars, as well as a range of by-products. In terms of contribution to the national GDP, the industry has been on the decline since the introduction of the sugar tax[15] in 2018 according to a Nedlac (2021)[16] report. According to this report, the industry contributed R12.5 billion to GDP in the 2019/20 period, down from R13.1 billion and R13.7 billion recorded in the 2018/19 and 2017/18 periods, respectively. Meanwhile, inflation (of both consumer and producer prices) has been rising rapidly since the beginning of 2022[17]. The rising prices will put pressure on the demand for sugar.

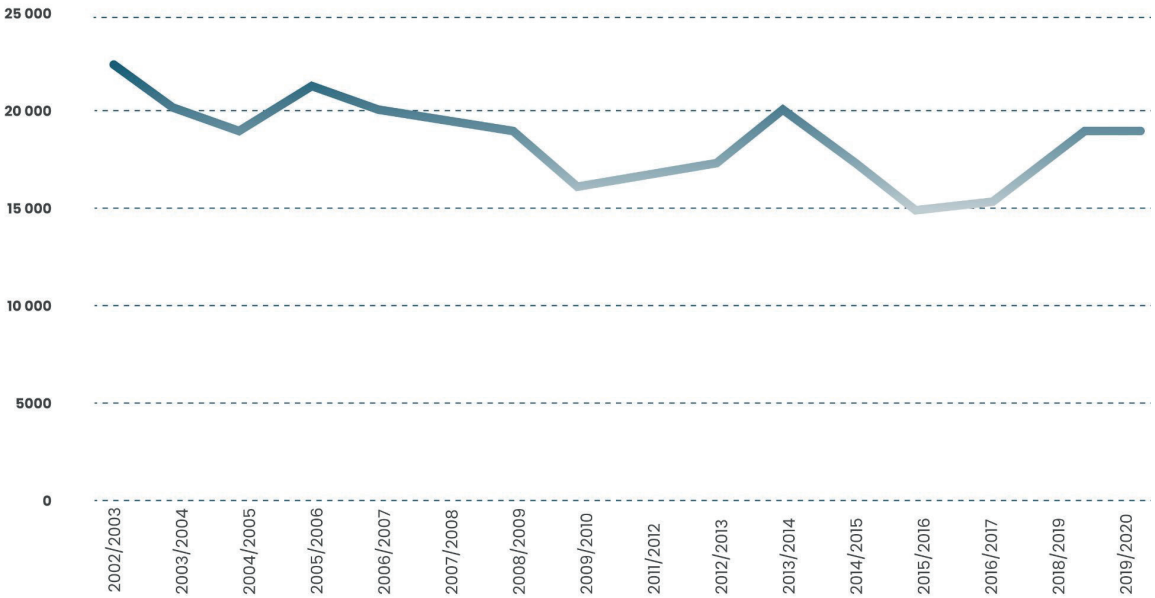
As it is, the sugar tax (also known as a Health Promotion Levy), had a detrimental impact on the demand for sugar, with demand dropping from 1.65 million tons to 1.25 million tons per year. This has forced South Africa to increase its exports to the global market, where prices are below the cost of production. This increase in exports has led to losses of approximately R2 billion each year. Nonetheless, South African sugar exports are to be expected to benefit from the likely notable increase in international sugar prices in the short to medium term. This has come about because of the overall increase in food prices following the Ukraine-Russian war, while at the same time, major sugar exporting countries such as India have started limiting sugar exports in efforts to curb rising prices at home.

[15] *A Health Promotion Levy, known as the sugar tax which was introduced in 2018 on sugary drinks with more than four grams of sugar per 100 ml. The tax is charged on non-alcoholic sugary beverages, except fruit juices.*

[16] *The National Economic Development and Labour Council (Nedlac) published a report titled, 'Economic Impact of the Health Promotion Levy on the Sugar Market Industry' in June 2021.*

[17] *CPI for sugar registered 3.5% y/y in April 2022, while PPI for sugar hurried to 9.3% y/y in the same month.*

Figure 13: Production of sugar cane in South Africa from 2000 to 2020



Source: Stats SA

South Africa's sugar industry is driven by sugarcane farming and sugar milling. The former is made up of 21 500 registered sugarcane growers, of which 1300 are large scale growers and 20 200 small scale growers. In the sugar milling sector, sugar is manufactured by six milling companies with 12 sugar mills (initially there were 14 mills, but one closed and one more was suspended) operating in the cane growing regions of Kwa-Zulu Natal and Mpumalanga. Moreover, there are approximately 85 000 people who are directly in cane production and processing, with a further estimated 270 000 jobs supported through upstream and downstream multipliers. Jobs created in the sugar industry sustain about one million livelihoods, the majority of which are situated in South Africa's rural areas. Additionally, the country's sugar industry generates an annual estimated average direct income of R14 billion through sugar sales in the South African Customs Union (SACU) region and world market exports.

In November 2020, the South African Sugarcane Value Chain Master Plan (Sugar Master Plan) was ratified. It aims to stabilise the industry, protect jobs and introduce reform in restructuring the industry. Through the Master Plan, the sugar industry has managed to provide R225 million to over 12,000 small-scale sugar cane growers as part of a R1 billion commitment to support black farmers. President Ramaphosa announced in his 2022 State of the Nation Address that the government will be expanding the provision of input vouchers and calling on other sectors to join this effort, in order to reach up to 250,000 small-scale farmers. Despite efforts being made to transform and reignite the industry, the fact that the Minister of Finance, Mr. Godongwana, confirmed an increase in sugar tax as of the 1st of April 2022 is concerning due

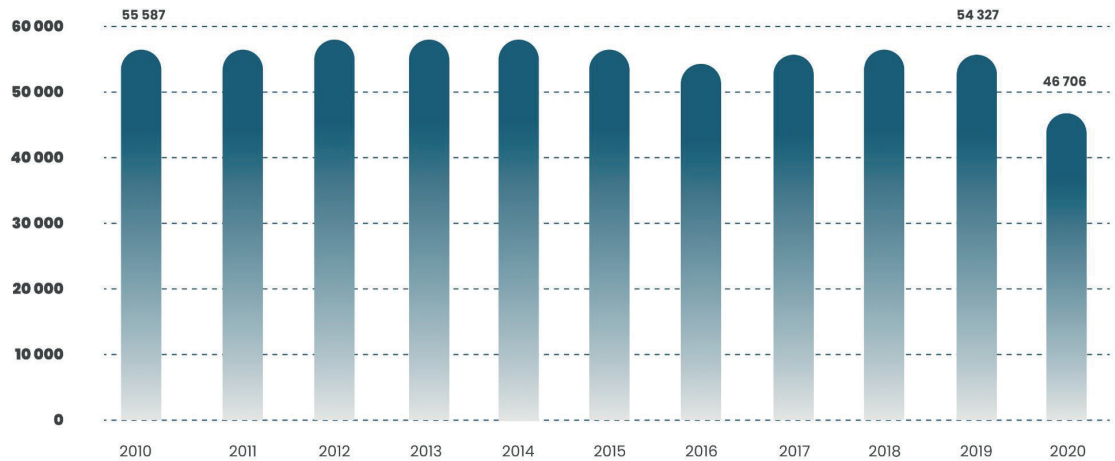
to its likely adverse impact on the industry. This is not only expected to stifle employment, but also dampen production in the already constrained industry. This, coupled with the impact of the Covid-19 pandemic, global prices that are below South Africa's cost of production, increasing volumes of low-priced tariff-free exports from eSwatini into the SACU market, as well as the recent catastrophic floods in the Kwazulu Natal (KZN) region, will be a major blow for the industry.

(iv) Furniture

In 2020, "Furniture and other manufacturing value added" amounted to R46.7 billion, down from R54.3 billion in 2019. This sub-sector which is considered a division of agro-processing made up 9.5% of the total manufacturing industry in 2020 (but contributed less than 1% to GDP). The sub-sector recorded the largest year-on-year decline during 2020 (-14%) in the past 10 years, as the effects of the Covid-19 pandemic continued to put pressure not only on demand in the industry, but also on the availability of raw materials. In addition, the civil unrest in some parts of the country during July 2021, that included the looting and destruction of property and infrastructure, had a negative impact on the sub-sector.

Overall, the performance of the furniture sub-sector of manufacturing remains constrained. Although output edged higher in March 2022 (5.5% month-on-month), it was weak in the first two months of 2022 (-16.1% month-on-month and -7.5% month-on-month in February and January 2022, consecutively). Consequently, furniture sales followed the same pattern, rising in March 2022 (10.7% month-on-month) after declining in February (-8.8% month-on-month) and January (-7.7% month-on-month) of 2022. The utilisation of production capacity rate by large furniture manufacturers was at 81% in February 2022, with the 19% under-utilisation due mostly to insufficient demand in the sector. For the sector to operate at a maximum, the supply of raw materials as well as the upscaling of both skilled and non-skilled labour needs to improve.

Figure 14: Furniture and other manufacturing, Industry Value added (R millions, constant 2015 prices), 2010- 2020



Source: Stats SA

Due to its labour-intensive nature, the furniture industry has the potential to reduce unemployment by absorbing some of the low-skilled labour that makes up the largest portion of South Africa's unemployed. In addition, the sector can play a more significant role in the economy through its contribution to the development of small, medium, and micro enterprises (SMMEs) and total exports. Furthermore, since furniture products can be developed in rural areas with minimal investment, the industry can contribute to the geographical spread of economic activity. However, in terms of international trade, the sub-sector's performance has been lacklustre.

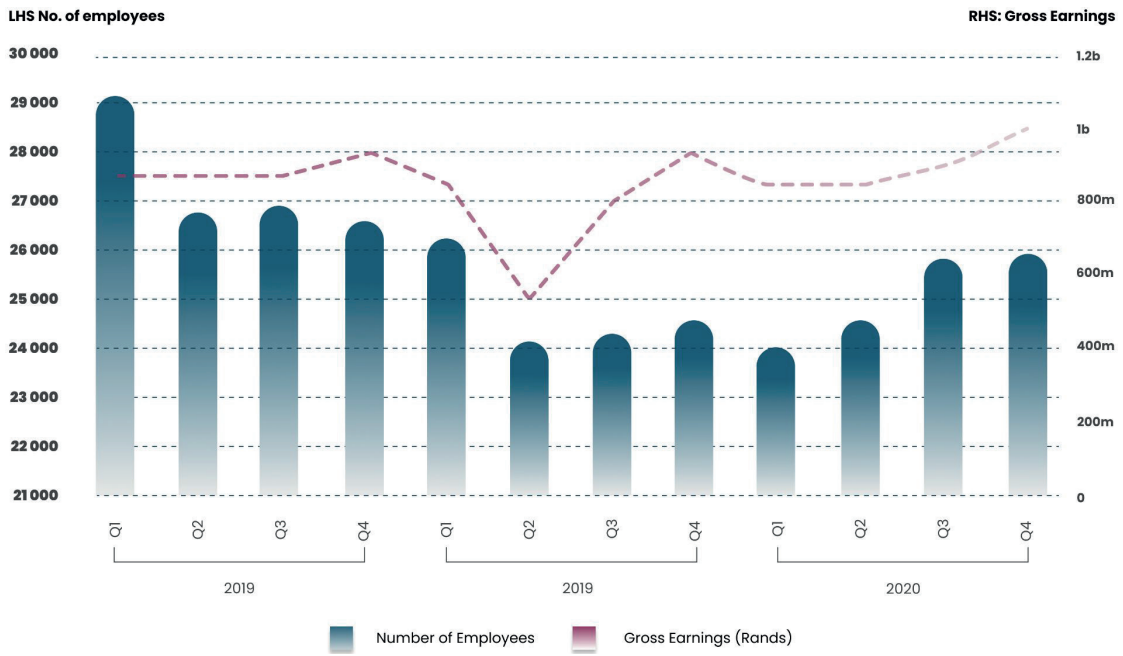
Looking at trade data, South Africa has been steadily losing its share in global furniture manufacturing. The rising supply of cheap Asian exports, accompanied by the declining investment in skills development and a lack of technological innovation resulting from low research & development funding over the last five years, has led to a decline in the levels of competitiveness for the industry internationally. The value of both exports and imports of furniture declined in 2020 (exports: -32.7% and imports: -32.1%). Close to 82 percent of the country's furniture exports are to other African countries, with Botswana being the highest furniture export destination at 17.6 percent.

According to the South African Furniture Initiative (SAFI)[18], most companies in this sector are small companies, many of which are family owned. Additionally, 61 percent of all entities listed with the furniture bargaining councils employ fewer than 10 people.

18 *annual report 2021*

Statistics South Africa shows that the number of those employed in this sector increased marginally in the fourth quarter of 2021 (25 841 vs. 25 798 in Q3-2021) with gross earnings increasing by 13.3% in Q4-2021 (versus a 4.9% increase in Q3-2021). A noteworthy feature of the industry is its low barriers to entry, which makes it possible to start small entry level companies that require minimum capital and human resources. These small companies might, in the long run be able to compete against the larger companies for market share.

Figure 15: Furniture, Employment Survey (No. of employees vs. Gross Earnings), Q1 2019 – Q4 2021



Source: Stats SA

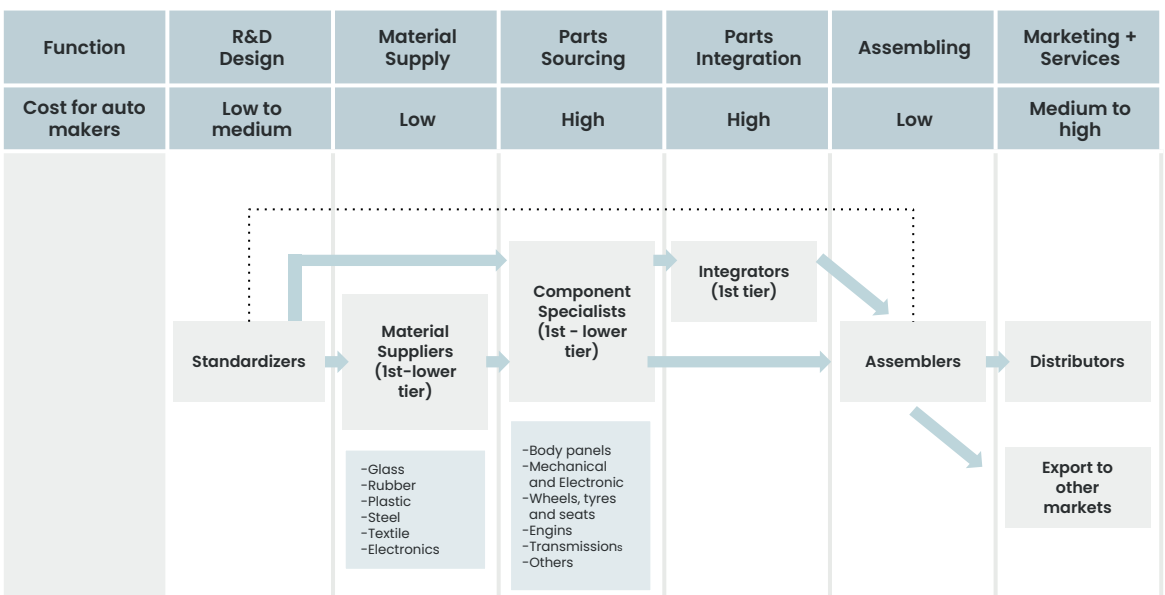
To help alleviate challenges in this sector, the Furniture Industry Master Plan (FIMP) was established and adopted in late 2021. The Master Plan sets clear guidelines and targets for the furniture manufacturing industry, and it guides public sector procurement as part of the government's efforts to support and stimulate the industry. Moreover, the South African Revenue Services (SARS) partnered with industry members in 2019 to form the SARS Furniture Forum that was aimed at addressing the industry's challenges. The forum seeks to provide support to inform trade and industrial policy directed at decreasing imports of furniture into South Africa, and to develop and implement a plan aimed at preventing illegal import practices to curb the spread of illegal and poor-quality imports which flood the local furniture market. All these efforts made in the industry are expected to regenerate and expand the sector, while contributing positively to the nation's economic growth and employment, especially labour-intensive opportunities.

(v) Automotive

The automotive value chain can be characterised as an automaker-driven network, as many automobile production systems are to a great extent controlled by automakers according to the Economic and Social Commission for Asia and the Pacific (ESCAP) (2009). The value chain comprises a complex mixture of firms of different sizes, types, and geographic scope, that produce large quantities of a variety of products from simple parts to technologically complex systems.

Figure 16 below illustrates that costs remain low to medium for those companies in the research and development (R&D) and design, material supply and assembling stages, while costs are medium to high for those in the parts-sourcing, parts-integration, and marketing and services phases. At the same time, an effective supply chain management that can succeed in reducing costs can lead to an improvement in the competitiveness of automakers. This could then result in the expansion of automotive value chains to low-cost neighbouring countries.

Figure 16: A simplified global automotive value chain



Source: UNESCAP

This capital and technology intensive industry, contributes 4.3 percent[19] to South Africa's GDP, contributes 0.7 percent to the global automotive manufacturing industry value, and is expected to trend upwards in the future.

[19] *In 2021*

The South African Automotive Master Plan (SAAM) 2021 – 2035 could lead to a growth in vehicle production, with an increase from 600,000 to 1.4 million vehicles per annum. It is therefore imperative to increase the percentage of parts and total cost of new motor vehicles assembled or manufactured domestically. This would have the benefit of not only transforming the automotive sector, but also facilitating the entry of Black Economic Empowerment (BEE) participants to the supply chain. As such, the original equipment manufacturers (OEMs), have committed to funding a Transformation Fund, which will partly assist in facilitating the entry of BEE participants in the supply chain.

According to the Automotive Industry Export Council's 2022 Automotive Export Manual, the value of new-vehicle and automotive component exports from South Africa increased by R31.8 billion to a record R207.5 billion in 2021, up from R175.7 billion in 2020. This translates to an 18.1% increase. Despite continued challenges in the supply chain, such as global semiconductor shortages, the sector managed to recover strongly from the weak levels seen in 2020 when the Covid-19 pandemic's impact on economies was the greatest. Across the vehicle and component manufacturers, just over 113 000 people were employed in the fourth quarter of 2021 (with gross earnings totalling R9.9 billion), compared with 109 000 people in the fourth quarter of 2020 (gross earnings equalling R9.6 billion). SAAM has communicated plans to increase the number of people working in the automotive industry to 224 000 from the 113 000. It is estimated that the sector has an indirect impact on 1.5 million people. With the country's automotive industry's export destinations increasing (152 countries in 2021 vs. 147 in 2020), it is no surprise that South Africa's seven major vehicle manufacturers invested R8.8 billion in 2021, the second-highest yearly figure on record (R9.2 billion in 2020).

The sector's utilisation of production capacity edged higher in February 2022 (81%) after recording 80.1% in 2021. The improvement in demand and shortage of raw materials assisted in moderating total capacity under-utilisation (22% in February 2022 vs. 22.7% in 2021).

The ongoing collaboration between the automotive industry and the government, which is improving automotive policies in the country, is encouraging as it could spur the sector to not only invest in production facilities and local plants, but also to develop efficient technology expertise. Additionally, the increasing demand for alternative mobility concepts could motivate manufacturers to further adapt and innovate, and in turn bolster expectations for employment opportunities to be created across the automotive value chain.

(vi) Steel

South Africa remains one of the largest steel producers in Africa, and according to the World Steel Association, it ranked 35th place in 2020 in terms of crude steel producing countries in the world from 28th place in 2019. The bulk of steel production in South Africa is done via the Basic Oxygen Furnace method (BOF)[20] (52.6%, while 47.4% is done through the Electric Arc Furnace method (EAF))[21] and this suggests that large-scale steel firms are likely to vertically integrate the production process backward into coal and iron ore mining to reduce costs.

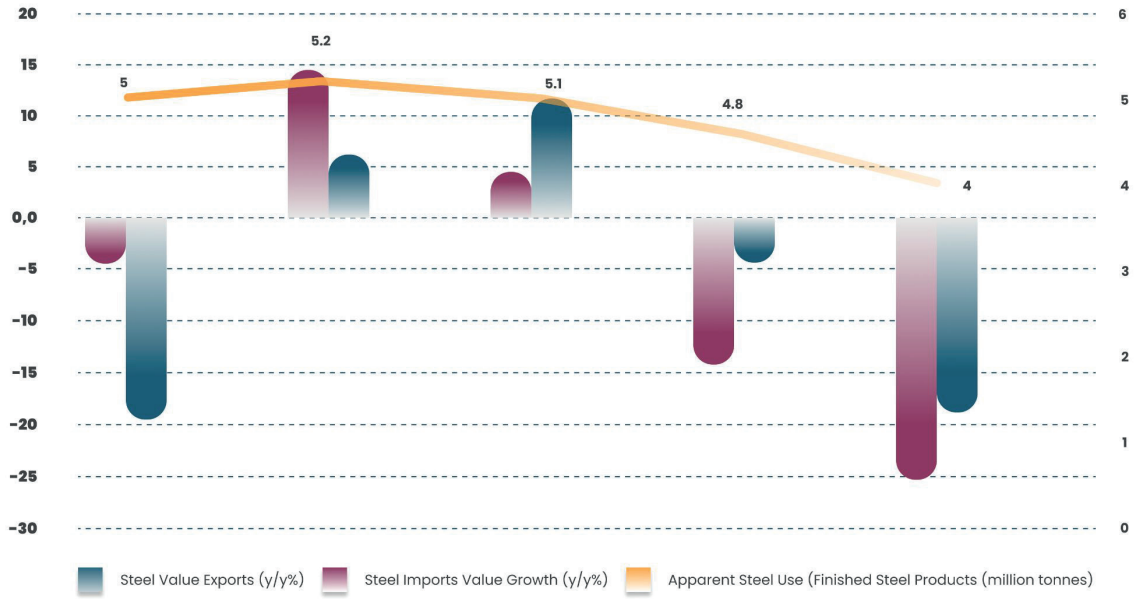
Locally, this sector remains under pressure as costs skyrocket (largely fuelled by the recent increase in energy prices that resulted in increasing costs of extracting and refining steel), subdued global steel prices, and the rise in cheap imports. The demand for steel (measured by the apparent steel use, ASU[22]) that has been on a downward trend since 2018 (5.1 million tonnes in 2018, 4.8 million tonnes in 2019 and 4 million tonnes in 2020) is consistent with the steep decline in steel exports, which recorded a negative growth of 25.6 percent in 2020 (from -14.7% in 2019). As such, the insufficient demand in steel, coupled with the increase in the shortage of raw materials and semi-skilled (to unskilled) labour led to the sector's total capacity under-utilisation rate rising in February 2022 (23.5% from 21.5% in November 2021). However, the fact that the shortage of skilled labour declined marginally is welcomed. For this sector's revival, the expansion of industrial activity and infrastructure development will be needed. Indirectly, the steel industry remains the facilitator of South Africa's construction, automotive and mining sectors.

[20] *Firms, producing steel requires sourcing a variety of raw material namely iron, coal and limestone.*

[21] *EAF doesn't involve iron making. This route reuses mainly existing steel (scrap). It uses some direct reduced iron (DRI) and pig iron for chemical balance.*

[22] *Apparent steel use (ASU) is defined as production plus net imports minus net exports.*

Figure 17: Apparent Steel Use (Finished Steel Products), Steel Exports Growth and Steel Imports Growth, 2016- 2020



Source: World Steel Association & Trend Economy Data

In May 2022, the Mainstreaming the Steel Master Plan Conference was held, with the conference giving clear action plans that the industry must collaboratively undertake to ensure the successful implementation of the steel industry master plan (the Steel Master Plan was ratified in June 2021). In addition, the conference also revealed the need for enhanced labour participation in workstreams and for the private sector to also increase its participation in this role. This could lead to an increase in job opportunities. As of the fourth quarter of 2021, the 'basic iron & steel' sector employed just over 22 000 people and had gross earnings of approximately R2.3 billion. Despite great plans being tabled to increase the viability of the industry, red tape will continue to weigh down the sector if it is not urgently addressed and it will prevent the sector from growing and creating much-needed jobs.

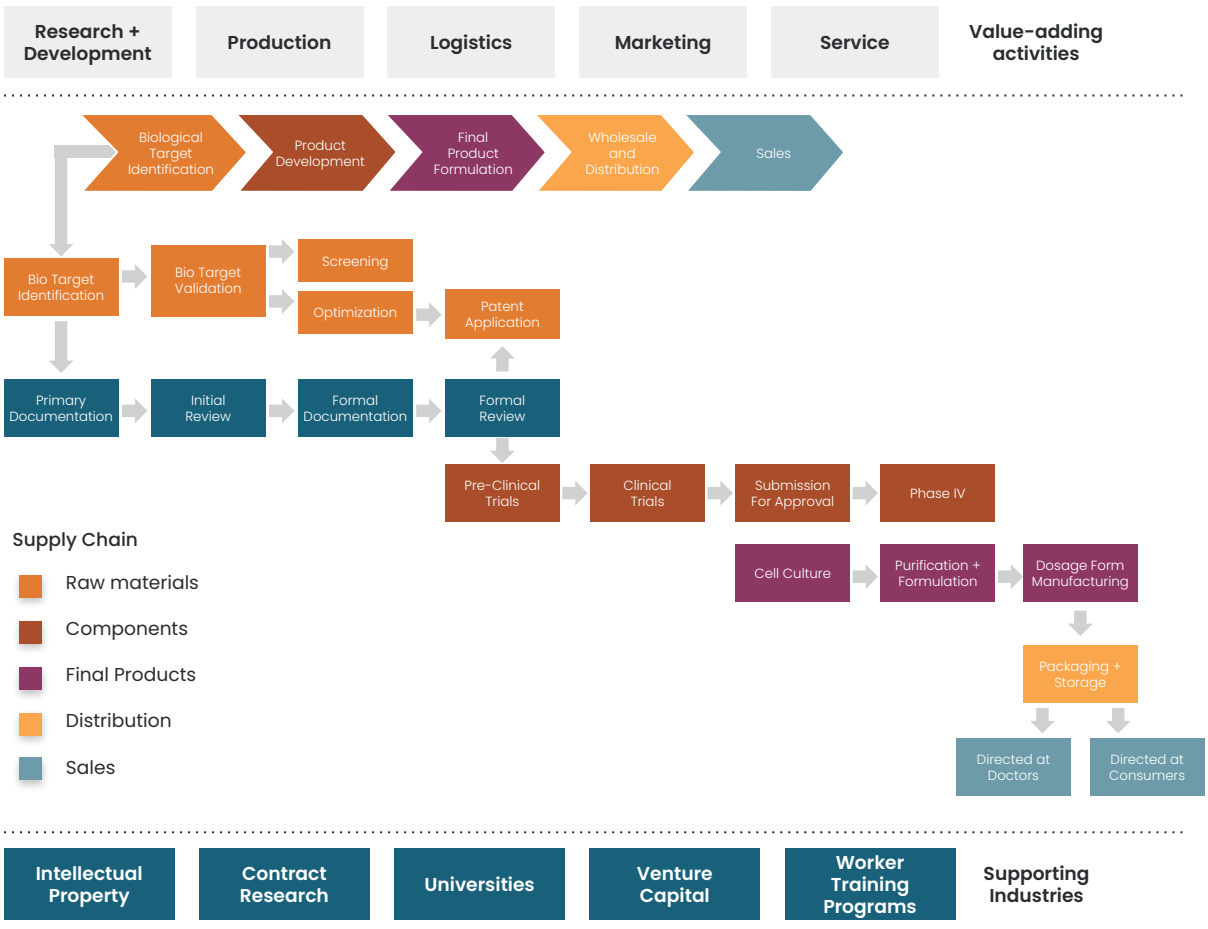
(vii) Pharmaceuticals

The South African pharmaceutical sector is worth approximately R20 billion annually as indicated in a report by Gauteng Business[23]. The sector is dominated by multinational pharmaceutical companies (MNCs), with over 90 percent of the MNCs listing South Africa as

[23] *2019/20 edition*

their regional headquarters (IPASA CEO[24], 2022). Therefore, because the sector is high-value-adding, the socio-economic benefits of South Africa being the preferred regional location remains an advantage. Figure 18 below shows three dimensions that work together to produce final products and services for the market, with "research & development, design, production, logistics, marketing and services" being the most important value-adding activities for the pharmaceutical sector.

Figure 18: Pharmaceutical Value Chain (value adding activities, supply chain and supporting industries)



Source: Global Economy (North Carolina)

In South Africa, the public health sector consumes the largest volume of pharmaceuticals, while a greater variety of products is available in the private sector. In essence, the private sector accounts for 80 percent of pharmaceutical industry sales by value and 20% by volume, while the public sector accounts for 80% by volume and 20% by sales. Retail trade sales rose sharply on a month-on-month basis in March 2022 (9.7%), after remaining sluggish in the first

[24] *Bada Pharasi, CEO for IPASA (The Innovative Pharmaceutical Association South Africa) stated this earlier in January 2022.*

two months of 2022 (-6.3% m/m in January and -9% in February). According to Invest SA's Fact Sheet (published by the Department of Trade & Industry), the South African pharmaceutical industry is expected to record sales of R73 billion by 2025, a substantial increase, compared to the R51 billion expected in 2022. However, in 2020, the sector's total expenditure amounted to R45.8 billion, while total income amounted to only R44.1 billion, which led to a loss in profit for the year. The industry spent most on 'purchases' and 'employment cost'.

Although close to 70 percent of the pharmaceutical products that are used are locally produced, numerous active pharmaceutical ingredients (API) and finished products are imported. With the Covid-19 pandemic adversely impacting demand for pharmaceutical products, total exports declined steeply in 2020 (-9.2%) while imports declined only marginally (-0.04%) in that period. However, in February 2022, the increase in the shortage of raw materials, together with the increase in shortage of skilled labour, were offset by the improvement in low levels of demand, leading to total utilisation of production capacity increasing to 83.9%, from 83.7% recorded in November 2021 and an 83.4 percent aggregate in 2021.

Since the sector is highly regulated and the development, production, marketing, and sale of pharmaceuticals are strictly controlled, it has become increasingly difficult for new companies to enter this competitive market. Additionally, high costs, the substantial dependence on imported APIs and finished pharmaceutical products as well as skills shortage (and the cost of specialised skills) are some of the challenges that continue to weigh heavily on the sector.

South Africa has completed the development of government's planned National Health Insurance (NHI)[25] scheme which is striving for universal healthcare (the intention is to create a single fund that will buy services on behalf of all South Africans). In July 2019, Cabinet approved the NHI Bill which is scheduled to be presented to the president for promulgation soon. The full implementation of the NHI is envisaged by 2026. Should the NHI materialise, a rising demand for prescription generic drugs, improved healthcare infrastructure and access, as well as increased local pharmaceutical production of generics are expected. What should also be noted is that the industry's contribution is not only through the fields of innovation, research, and development, but also through direct and indirect employment and a commitment to growing local capabilities.

[25] *National Health Insurance (NHI) is a health financing system that is designed to pool funds to provide access to quality affordable personal health services for all South Africans based on their health needs, irrespective of their socio-economic status. NHI is intended to ensure that the use of health services does not result in financial hardship for individuals and their families. NHI is being implemented in phases over a 14-year period that started in 2012. It will be established through the creation of a single fund that will buy services on behalf of the entire population, The funding for NHI will be through a combination of various mandatory pre-payment sources, primarily based on general taxes.*

03 LOCALISATION AND GOVERNMENT PROCUREMENT

Against the backdrop of the evolving manufacturing environment, current elevated risks as well as potential opportunities for the sector, it is of paramount importance that government policy plays an important role in supporting South African manufacturing. One of the proposals made by the NDP 2030 regarding the stimulation of the country's manufacturing sector is "leveraging public and private procurement to promote localisation and industrial diversification".

Already globally, procurement by governments accounts for a significant share of economic activity, with public procurement amounting to 15 to 20 percent of GDP on average in developed countries (Anderson et al (2011), Lamy (2009) and Rickard and Kono (2013)). Similarly in South Africa, government is the country's largest buyer of goods and services, including construction work, according to the National Treasury (2015). Most recently, government introduced the "Economic Reconstruction and Recovery Plan" in 2020 amid the Covid-19 pandemic as a means of stimulating the South African economy, and the Plan has 'industrialisation and local procurement' as one of its key priority areas.

In South Africa, government procurement reforms began following the onset of the country's first democratic government after 1994. Along with promoting good governance, the reforms were aimed at addressing certain socioeconomic objectives through a preference system. These reforms were further supported by legislative measures including the Preferential Procurement Policy Framework Act No. 5 of 2000 (PPPFA). Section 2 of the PPPFA states that an organ of the state must determine its preferential procurement policy and implement it within a given framework, following a preference point system. The Revised Preferential Procurement Regulations aimed at strengthening localisation came into effect in 2011.

Recently, government[26] has introduced a strategy for the manufacturing sector that has a focus on the development of competitive industries. Part of the strategy has been the development of plans under key manufacturing sub-sectors known as Sector Master Plans, which are aimed at improving performance, job creation, competitiveness and efficiency, as well as economic inclusion. Six Master Plans have thus been developed and being implemented in the sub-sectors of automotives, clothing, textile, footwear and leather, poultry, sugar, steel and metal fabrication, and furniture (DTIC, 2021).

[26] *Under the Ramaphosa administration*

Under the aforementioned Economic Reconstruction and Recovery Plan (2020), plans to promote manufacturing through localisation will be pursued through the following strategic objectives:

i. reducing the proportion of imported intermediate and finished goods;
ii. improving the efficiency of local producers; and
iii. developing export competitive sectors that can expand the sales of South African made products on the continent and beyond.

The Plan further highlights that "Priority will be placed on key value chains such as in construction; agro-processing; healthcare; basic consumer goods; capital goods including equipment and industrial inputs used in infrastructure projects; and transport rolling stock focusing on automobile and rail assembly component production" (Republic of South Africa, 2021 p.12). Ultimately, and based on the objectives of the Economic Reconstruction and Recovery Plan, and under the "localization initiative", the Nedlac partners have agreed to work together to bring down the country's "non-oil" import bill by 20 percent in the next five years (DTIC, 2021).

South Africa is not alone in pursuing localisation and making use of government procurement to boost its manufacturing sector. Globally, countries have adopted procurement policies that are aimed at enhancing national interests, and these include local procurement policies intended to promote local industry. For example, the economic stimulus package contained in the United States' American Recovery and Reinvestment Act (ARRA)[27] largely required that manufactured goods including steel and iron used in the construction of public works projects that were funded by the Act be made in the country. The Buy American provisions of the ARRA were issued during April 2009. In Brazil, domestic sourcing of goods and services is justified under the Constitutional principles, determining that procurement by government be carried out via public tenders regulated by federal law in which preferential treatment is given to small companies. In addition, during public tender processes, cases where there is a tie between bidders under same conditions, preference is then given to goods and services produced or rendered by Brazilian companies of national capital, produced in Brazil, and produced or provided by companies that invest in research and technology in Brazil. Finally, in China, government procurement also favours goods and services or projects from Chinese sources. Under China's Government Procurement Law (GPL) (promulgated in June 2009), government procurements are required to be derived from domestic sources, with prescribed exemptions, (LLC, 2010).

[27] *The ARRA was a part of the fiscal stimulus package by the U.S. in response to the Great Recession of 2008.*

In light of the South African government's renewed drive for localisation, the DTIC (2021) argues that the strategy is not a departure from an engagement in global markets, but rather more about changing South Africa's terms of engaging in global markets to ensure the country is no longer mainly just exporting raw materials. Hence, it is based on the mission to build the local industrial capacity for both the domestic market as well as for export markets. It is important to note from the analysis in section II "The Manufacturing Sector and the South African Economy" above that of South Africa's total exports, only 38 percent were manufactured in 2020. This indicates that the bulk of the country's exports have not had much value added to them, hence putting South Africa at a disadvantage in terms of lost opportunity, i.e.: those opportunities that come with expanding its industrial capacity as outlined throughout this report.

04 MODELLING THE MANUFACTURING SECTOR IN THE SOUTH AFRICAN ECONOMY

In this section we present a simulation of several investment scenarios for the South African economy. The purpose of a simulation exercise is to better understand, in advance, the consequences of policy or other actions that impact on the broader economy. The results of the exercise depend on multiple factors and are not cast in stone but represent a 'best approximation' of the outcome should no other major economic shocks occur in the interim.

a. The mechanics of the investment simulation exercise

The model of the South African economy that is used is a CGE model, calibrated to a 2015 SAM[28], combined with a SAM multiplier analysis. This approach allows a distinction to be drawn between short term and medium term results. The fundamental nature of investment is that it is an inter-temporal process whereby a sacrifice (investment) is made today for future expected benefit. Therefore, the immediate or short term response of the economy may not reflect the boosts to output, consumption and incomes that would be expected from investment. As time passes, however, investment expenditures work their way through the economy to yield higher output, consumption and incomes in the medium to longer term.

[28] *This is the latest publicly-available SAM but, due to the impacts of the Covid-19 pandemic, almost certainly better reflects the size of the South African economy in 2022 than in 2019.*

The process by which this happens is complex. The initial round of investment expenditure is used to purchase 'investment goods' – plant, machinery, vehicles, buildings (whether existing or newly constructed), office equipment and consumables – as well as to hire staff. This expenditure round places pressure on prices and leads to a rise in the price and wage level (the latter depending on the relative shortage of the particular skill level). These demand and price pressures cause the initial crowding out of the other two main components of domestic absorption – consumption and government expenditure. On the other hand, imports usually initially rise relative to other expenditure components and relative to exports. This is because of the important import component in investment goods for many manufacturing sectors. The automotive industry, for example, requires equipment that is not produced domestically and is only available imported from the rest of the world. The same is true for many, if not most of the manufacturing sectors. This decline in net exports causes an initial real depreciation of the currency, which suppresses non-investment import expenditures.

Due to this demand, price and exchange rate pressures initially suppress non-investment domestic expenditure and can lead to very modest or even mildly negative short term impacts on the level of domestic GDP. As time passes, however, these effects are dissipated and reversed. The initial round of investment spending works its way through the economy and profits, leading to a rise in incomes and wages. In turn, these contribute to increased tax revenues and higher consumption and government expenditures. As real activity increases, the pressure on prices is relieved and inflation declines toward a steady-state level.

The improved production capacity – both as a result of gross capacity improvements and technology-driven gains – as a result of the investment round, makes exports more competitive in international markets. The volume of exports increases as foreign buyers substitute into cheaper South African exports, and export values rise. This reverses the downward pressure on the real exchange rate, prompting the exchange rate to appreciate back towards its original level. This appreciation also helps to sustain import demand driven by other components of domestic expenditure.

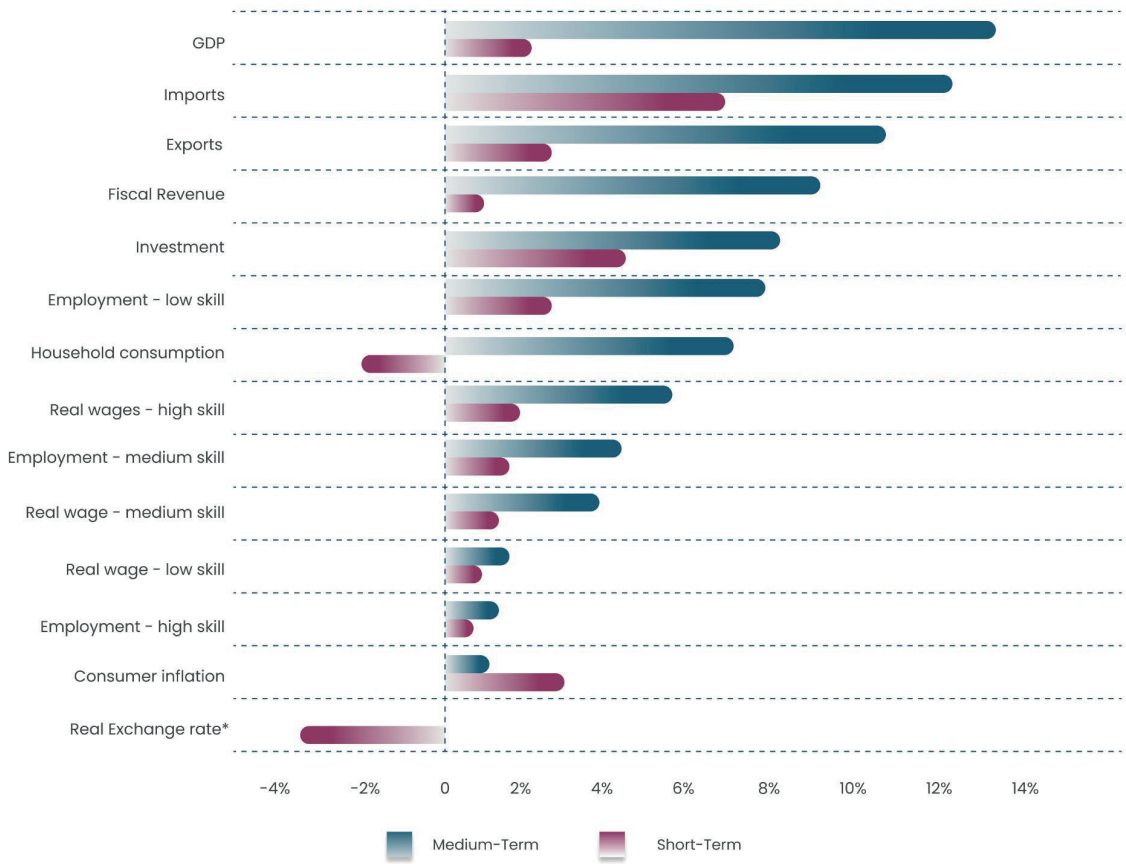
If all goes well, meaning provided there are no other economic or policy shocks in the interim, the investment into manufacturing will yield higher GDP, higher incomes, higher expenditure, greater employment, positive technology transfer, an expanded capital stock and higher fiscal revenue, without any significant impacts to longer run inflation or exchange rate levels. It is this process that is simulated for the following scenarios.

(i) 10% increase in investment in the entire manufacturing sector

The results of a simulation of a 10% increase in investment in the entire manufacturing sector are presented in Figure 19 below. As is evident, the effect of investing into the entire manufacturing sector – some 24% of the entire productive capacity of the South African economy – is strongly positive for GDP growth, employment (especially for lower skilled), wages (especially for higher skilled), household consumption, total investment and government revenue.

In the short term, some negative impacts are experienced due to the crowding-out of private consumption and the inflationary pressure on prices and downward pressure on the real exchange rate, but these are reversed in the medium term.

Figure 19: Results of 10% increase in manufacturing investment in all sub-sectors



Source: PAIRS

It is important to note that the full impacts on the economy are felt not just in the manufacturing sector but across the board in other sectors – primary and tertiary as well. This means that the agriculture, mining and services sectors also benefit. In fact, services such as construction, finance, communications and business services all benefit in that they are generally forward-linked to the value chain of manufacturing industries. Other services such as distribution/trade and transport are backward-linked to the value chain of manufacturing and therefore also benefit[29].

(ii) 10% increase in investment into specific sub-sectors or industries

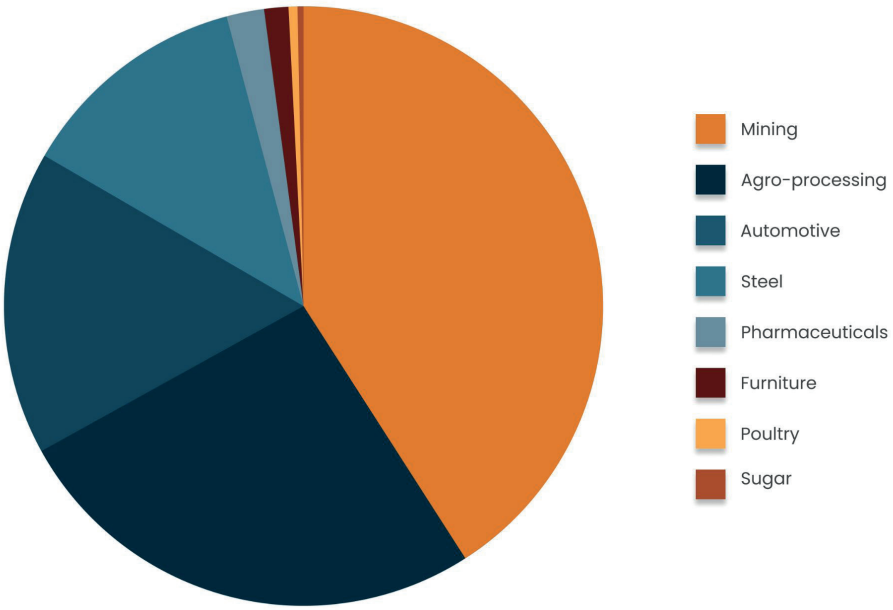
Similar simulations were undertaken for a 10% increase in investment into the following sectors:

i. Agro-processing
ii. Automotive
iii. Furniture
iv. Mining (not a manufacturing sector)
v. Pharmaceuticals
vi. Poultry
vii. Steel
viii. Sugar

Impacts on GDP for all the above sectors' 10% investment boosts are presented in the pie chart Figure 20, which ranks the sectors clockwise from greatest to the smallest impact on GDP.

[29] Backward-linked' value flows are those that are inputs into the production of a sector, in turn its outputs could be inputs into another sector's outputs, in which case it is 'forward-linked' to that sector. The flow of value starts with raw materials and ends, after multiple links in the value chain, with services related to marketing and customer services.

Figure 20: 10% increase in investment into specific sub-sectors: ranked impacts on GDP



Source: PAIRS

Results are presented below for the two leading manufacturing sub-sectors – agro-processing and automotive, as well as those of the mining sector – the other sub-sectors' results are given in the Annexes. The results for the mining sector are visualised in a chart, Figure 21.

Table 2: Results of a 10% increase in investment into the agro-processing manufacturing sub-sector

Short and medium term results		
Percentage increase over base year value		
	Short Term	**Medium Term**
GDP	-0.3%	2.92%
Employment - low skill	0.8%	2.44%
Employment - medium skill	0.4%	1.32%
Employment - high skill	0.1%	0.39%
Real wages - low skill	0.2%	0.5%
Real wages - medium skill	0.4%	1.08%
Real wages - high skill	0.5%	1.58%
Household Consumption	-1.5%	2.16%
Consumer inflation	-0.3%	0.0%
Investment	0.6%	2.35%
Exports*	0.4%	1.8%
Imports	1.4%	2.87%
Fiscal revenue	-0.4%	2.83%
Real exchange rate*	-0.9%	0.0%

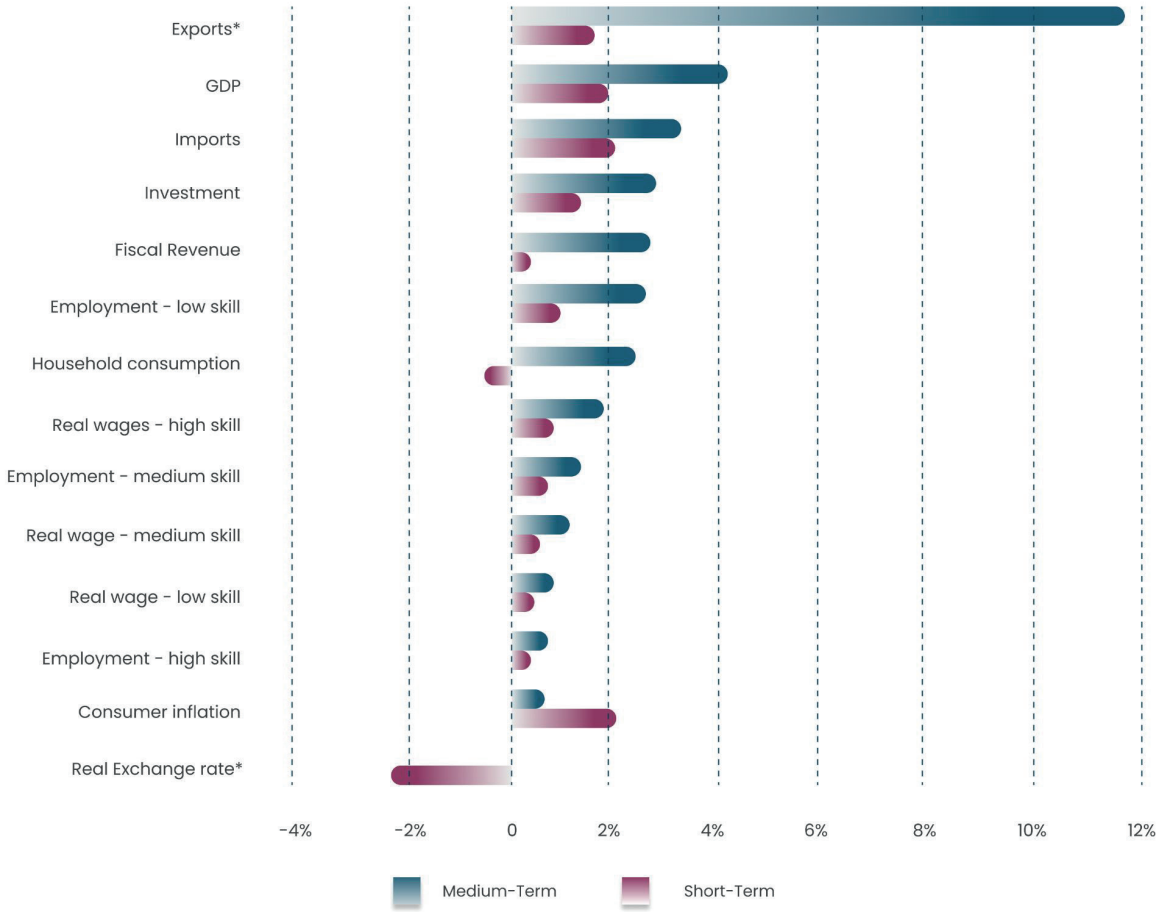
Source: PAIRS

Table 3: Results of a 10% increase in investment into the automotive manufacturing sub-sector

Short and medium term results		
Percentage increase over base year value		
	Short Term	**Medium Term**
GDP	0.2%	1.56%
Employment - low skill	0.3%	0.98%
Employment - medium skill	0.2%	0.55%
Employment - high skill	0.1%	0.17%
Real wages - low skill	0.1%	0.2%
Real wages - medium skill	0.1%	0.45%
Real wages - high skill	0.2%	0.70%
Household Consumption	0.0%	0.91%
Consumer inflation	0.2%	0.0%
Investment	0.4%	1.11%
Exports*	0.2%	1.7%
Imports	1.2%	1.76%
Fiscal revenue	0.1%	1.15%
Real exchange rate*	-0.5%	0.0%

Source: PAIRS

Figure 21: Results of 10% increase into the mining sector



Source: PAIRS

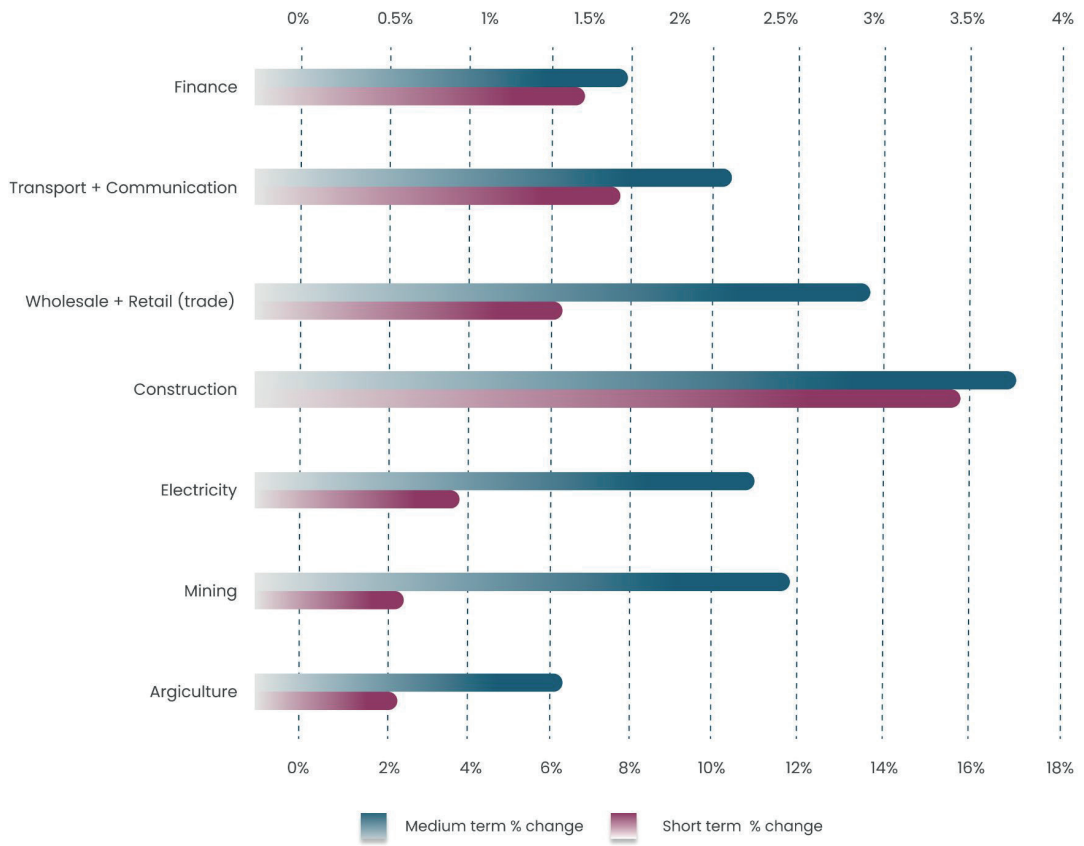
The agro-processing sector makes up about a third of the manufacturing sector and about 8% of all productive economic activity. This compares with the mining sector at about 7% of all productive economic activity and the automotive sector at just over a tenth of the manufacturing sector and about 2.6% of all productive economic activity. Of these sectors, mining and the automotive sector are a bit more 'dynamic' in their ability to translate a given value of investment into GDP, employment, household consumption and fiscal revenue. However, the agro-processing sector surpasses the other two in its ability to create low and medium-skilled jobs, which are desperately needed in South Africa.

(iii) 10% increase in manufacturing investment in specific sectors on other sector's outputs

Due to the circular flow, each investment scenario has repercussions not just for its own sector but all other sectors, even those to which it is not directly linked. This is because every sector is ultimately linked, sometimes indirectly via its links to intermediate sectors.

In order to gauge the distributed impacts of the investment boosts, a set of results looking at the output impacts of the previous simulations on a group of seven sectors is given in Table 4. The top section of the table presents the output impacts on the seven sectors of the main simulation, i.e.: an investment increase for the whole of the manufacturing sector by 10%. This same data is also visualised in the bar chart in Figure 22. The table data also contains a row for the base output levels of each sector (in Rm). The short and medium term percentage increases are given below, and thereafter for each of the other investment boost simulations.

Figure 22: Results of 10% increase in manufacturing investment on other sectors' outputs



Source: PAIRS

Table 4: Results of a 10% increase in manufacturing investment in specific sub-sectors on other sectors' outputs

Short and medium term results Rm and percentage change							
1. 10% Increase in investment in manufacturing - whole manufacturing sector							
	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Base	218 790	533 557	177 695	409 535	612 707	701 206	615 865
Short term % change	0.54%	0.57%	0.85%	3.50%	1.39%	1.74%	1.55%
Medium term % change	6.52%	11.75%	10.85%	17.07%	13.38%	10.51%	8.54%
2. 10% Increase in investment in manufacturing - agro-processing sector							
	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	1.22%	0.28%	0.69%	1.04%	0.41%	0.66%	0.57%
Medium term % change	12.28%	2.64%	2.81%	4.91%	3.94%	3.04%	2.49%
3. 10% Increase in investment in manufacturing - automotive sector							
	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.05%	0.07%	0.12%	0.21%	0.15%	0.16%	0.12%
Medium term % change	0.63%	1.51%	1.27%	2.25%	1.74%	1.35%	1.10%
4. 10% Increase in investment in manufacturing - furniture sector							
	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.0197%	0.0068%	0.0090%	0.0186%	0.0131%	0.0241%	0.0230%
Medium term % change	0.21%	0.12%	0.12%	0.21%	0.17%	0.14%	0.11%
5. 10% Increase in investment in the mining sector							
	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.18%	2.07%	0.46%	0.68%	0.35%	0.44%	0.39%
Medium term % change	1.37%	10.89%	3.95%	5.62%	2.84%	3.47%	2.87%

6. 10% Increase in investment in manufacturing - pharmaceutical sector

	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.01%	0.03%	0.03%	0.04%	0.04%	0.02%	0.02%
Medium term % change	0.14%	0.22%	0.23%	0.33%	0.26%	0.21%	0.17%

7. 10% Increase in investment in manufacturing - poultry sector

	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Base	179 959	480 941	138 238	319 113	494 669	384 270	485 953
Short term % change	0.04%	0.02%	0.02%	0.03%	0.02%	0.03%	0.03%
Medium term % change	0.46%	0.14%	0.15%	0.27%	0.21%	0.17%	0.14%

8. 10% Increase in investment in manufacturing - steel sector

	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.07%	0.15%	0.12%	0.17%	0.12%	0.13%	0.15%
Medium term % change	0.50%	1.30%	1.26%	1.50%	1.26%	1.01%	0.77%

9. 10% Increase in investment in manufacturing - sugar sector

	Agriculture	Mining	Electricity	Construction	Wholesale & Retail (trade)	Transport & communications	Finance
Short term % change	0.021%	0.006%	0.005%	0.011%	0.009%	0.010%	0.052%
Medium term % change	0.165%	0.049%	0.054%	0.096%	0.077%	0.059%	0.048%

Source PAIRS

A pattern that is prevalent across the simulations is the strong impact of the investment boost on the services, construction, trade, transport, communications and finance. Therefore, although this investment is directly into manufacturing sectors, forward and backward-linked services sectors also benefit substantially due to the multiplier effects of the circular flow. A similar pattern holds for the mining sector, which is not part of the manufacturing group. However, there are some differences, the 10% increase in investment into the mining sector differs from the balance of the simulations, having a proportionately greater impact on electricity output[30] and a lower proportional impact on trade services.

[30] Note that strictly-speaking, the electricity sector should have been modelled as output-constrained. Unless the national electricity supplier, Eskom, can solve its supply issues in the medium term, these simulations will reflect more of an optimistic than a 'middle of the road' scenario.

Figure 23: Results of a 10% in manufacturing investment on mining and agriculture sectors on specific variables

Source: PAIRS

(iv) 10% increase in manufacturing investment on mining and agriculture sectors on specific variables

The final set of results (visualised in Figure 23) focuses on the impacts of the whole-sector investment boost on the levels of employment, fiscal revenue and exports in South Africa's two primary production sectors - mining and agriculture. The employment impacts are stronger across the board for the mining sector, a reflection of the relatively increasing level of technology uptake, automation and rising capital intensity in the agriculture sector. Fiscal revenue results reflect the greater impact on incomes of the mining investment, due to its effects on employment and consequently income taxes.

For export demand, which is exogenous to a small open country such as South Africa, certain assumptions were made. Firstly, as with the other simulations, the initial real depreciation is assumed to be reversed in the medium term. However, a smaller export boost for mining is shown, reflecting our projection of a slowing commodity cycle into the mid 2020s. Since the commodity cycle affects minerals more strongly than agricultural products, the exports growth is assumed to be smaller than that for agricultural products.

b. Summary of results of simulations

This section presented results of a set of CGE simulations of various investment boosts to the manufacturing sector of the South African economy. Due to supply constraints in the short term, the full benefits of the investment increases are only felt in the medium term but are considerable. Specifically, the simulations show a medium term boost to GDP of 13%, unskilled employment creation of 8%, an overall boost to investment across the economy of 8.3% and an additional 9% increase in tax revenues.

Ex-post calculations of actual numbers of jobs created (across all skill levels), using best available estimates of current employment, show medium term gains of 75 300 new jobs in manufacturing, 11 500 new jobs in mining and 10 100 new jobs in agriculture.

There were some caveats noted, among them the need for the national energy policy, and hence energy availability, to overcome its supply constraint and also the assumption that export demand is not constrained but follows a long term growth trend. The latter is of course dependent on global economic events that are not within the control or influence of South African policy makers and investors.

05 Policy Implications and The Way forward

The preceding analysis and the CGE model projections illustrate the rich potential that the manufacturing sector in South Africa has. The policy review of the selected industries and sub-sectors have furthermore highlighted the shift in the right direction of developing "master plans" for specific industries. This policy move is critical insofar as it recognizes the fact that each sector, sub-sector and industry has specific conditions and limitations that require specific considerations. More often than not, there is a critical need for the existing industry role players and policy makers to jointly assess the existing circumstances, operational parameters and unlock the potentials accordingly.

In the context of the "industrialisation master plans", the pre-requisites for success may be divided into two separate categories as follows:

a. Transversal Requirements set up the infrastructural platform which enables industrialisation and its sustainability over time. The world over, these include, energy, water, skilled human resources, transportation and export logistics network, scientific capabilities for R&D, and supportive regulatory environment. Hence the "investability" of the industrial enterprises demands ongoing and special socio-political attention.

b. Industry-specific requirements relate to the complementary inputs that are unique to a given industry/sub-sector in a given period of time. Such requirements may be technical and/or organisational or institutional in nature. Critically, the requirements vary depending on the structure of the industry at a given point in time, its maturity and the loci of activities along the value chain. A salient aspect of these industry-specific requirements relates to the nature of the product. The requirements of intra-industry products are far more complex than final (consumer) items. To this end, three mega trends are at play; these are:

i. Technological disruptions;
ii. Environmental sustainability imperatives; and,
iii. Consumer activism underpinned by global connectivity and real time communication via diverse digital platforms.

The upshot of these forces leads to an effective need for policy and business strategy. Resilience and robustness are the emerging requirements of industrial/commercial success.

In this context, the success of SA's re-industrialisation, or the revival of the national industrialisation drive, rests on an effective partnership framework within which the public sector implements a well-coordinated, intergenerational infrastructure provision programme whilst the private sector in diverse industries focuses on industry-specific dynamics. In each sub-sector or industry, there is need for an appropriate institutional framework for coordination and implementation review (or a 'Project Management System') of these parallel action plans.

Last but not least is to have an open and public discourse about the policies, the reviews and the learning so that all the major stakeholders can contribute to, and assess the outcome of, the action plans at play. wn

IEC Young Professionals Programme essay competition winners announced

The IEC Young Professionals (YPs) programme was started by the International Electrotechnical Commission (IEC) in 2010, targeting engineers working in the electrotechnical industry in the early 20s to mid-30s.

The objective is to ensure that the technical work of the IEC will be future-proofed with a growing number of new-generation technical experts familiar with standardisation and the role of the IEC.

The first IEC YP programme took place in 2010, and South Africa was represented then and every year.

2023 Topic: What safety and performance requirements should be included in the standard for the low-cost backup power system considering the Electricity/energy issues in South Africa—things to consider: cost, performance, cooling, etc.

The winners of the two candidates from South Africa are:
1st place - Mr Otshepeng Moraka
2nd place – Mr Leon Roos

LOW-COST BACK-UP POWER SYSTEMS

By Mr Otshepeng Moraka - 1st place winner

1. INTRODUCTION

South Africa's national power utility, Eskom, experiences high demands that exceed the available supply due to unplanned maintenance, aging coal-fired power stations and delays of new energy generation to come online. To balance the demand and supply of electricity, Eskom implements load shedding which is a method of reducing demand by requesting municipalities and its customers to switch off power distribution in accordance with the stage severity (1-8). Municipalities manages this by rotating the power outages on a schedule, usually 2-4 hour durations, from group to group of their residential, industrial and commercial customers.

Load shedding has led households to purchase low-cost back-up power systems to power their internet routers, CCTVs, laptops, cellphones, lighting, and television sets. The low-cost back-up power systems are growing in popularity because they require less investment than rooftop PV, generators etc. However, an ownership increase of the low-cost back-up power systems leads to an increasing need of battery waste management. Lithium-ion batteries that end up in landfills can cause fires and explosions. Thereafter, toxic chemicals will be released into the air which negatively affects air quality and contributes to global warming. Furthermore, the vaporized form of batteries gets trapped in the atmosphere and pollutes lakes and streams in the form of rain [1].

On the 14th March 2023, the National Consumer Commission issued a media statement to recall a batch of GIZZU 300Wh and 500Wh portable power stations. The devices had a lithium-ion battery manufacturing flaw which presented a small possibility of the product self-combusting and melting when it was charged [2]. Thus, the recall shows the importance of having standards that can help to prevent and reduce the chance of accidents and injuries while consumers use products. This essay starts by showing the power outages days experienced by South Africans and describes the resultant environmental and energy efficiency impact, along with proposed standards, of the low-cost back-up power systems usage. Thereafter, the charging performance standards that need to be considered to limit power demand are covered. Afterwards, lithium-ion battery safety standards are proposed from a perspective of the end-user and back-up system interaction. Then, the standards for the power electronics that charge the back-up systems and deliver power to appliances and devices are proposed. Next, the diagnostics standards are proposed and followed by lighting lanterns that are used at night during load-shedding. Subsequently, the back-up system cost impact of conforming to standards are considered. Lastly, the conclusion covers the overall aspects that need to be considered for the low- cost back-up power system standards.

2. MAIN CONTENT

2.1. Low-cost back-up power system demand

In 2022, load shedding occurred for 3 773 hours which was 43% of the hours in the year. However, these hours do not reflect the actual power outage hours experienced by South Africans in their households. As of 16 April 2023, independent energy analyst Pieter Jordaan's data showed that the average sum of power outage days experienced by South Africans, between 2020 and 2023, was 74.5 days [3]. These power outage days can be used to determine the number of mini uninterruptible power supplies (UPSes) a South African end-user would have bought over the 2020-2023 period. The assumptions and results of the study are shown in the table below and an end user would have bought their second mini-UPS.

Table 1: Assumptions and calculations of study to determine number of mini-UPSes an end-user would have required.

Assumptions			Calculations	
Depth of discharge	70%		Load shedding internet router energy consumption for 2020-2023*	17 880 Wh
Mini-UPS energy capacity	46 Wh		Mini-UPS energy delivered over lifetime (500 cycles)	16 100 Wh
Charge-discharge cycles	500		**Number of mini-UPSes required over load shedding period 2022-2023***	**1.11**
Internet router power	10 W			

*16 April 2023

i. Environmental Impact

The lithium (or lithium equivalent) content for a battery pack can be worked as 0.3 grams per amp hour capacity [4]. Therefore, it would require 1 852 mini-UPSes mentioned in the table above to match the 8kg lithium content of electric vehicle's battery pack. The lithium content of portable power stations is much more than mini-UPS, which indicates that the current means to combat load shedding may create a waste management problem if not addressed. Furthermore, lithium recycling facilities do not exist in South Africa and most of the lithium-ion battery waste is either stockpiled, landfilled, or shipped to recycling facilities abroad [5]. Thus, standards need to provide guidance of the disposal and recycling of the low-cost back-up power system to protect the environment.

ii. Energy Efficiency Impact

The residential sector can account for up to 35% of national electricity demand during peak times and this demand may be reduced by using more energy efficient appliances and devices. In 2005, the first National Energy Efficiency Strategy (NEES) was released to promote energy efficiency. In December 2016, the Draft Post-2015 NEES was published for comment, and it included targets to reduce average specific energy consumption of new household appliances purchased by 33% and 20% improvement in average energy performance of residential building stock by 2030 [6].

Assuming 3 020 longer cycle mini-UPSes, with 90% or 80% operation efficiency, that each powered an internet router in 3 020 homes over the load shedding period shown in Table1 above, the losses would sum up to a day's energy consumption (30 kWh) of about 200 and 450 households, respectively. The

assumed 3 020 units were based on the number of comments from an online retailer's website for mini-UPSes and there could be much more units sold. Thus, standards should consider the energy efficiency of low-cost back-up power systems when additional power consuming requirements are developed. This would ensure that the NEES targets are not compromised.

2.2. Charging performance of low-cost back-up power system

Manufacturers of the low-cost back-up power systems are adapting their products for load shedding stages which have a four-hour recharging window. This might be achieved by implementing fast charging on the back-up systems and will lead to a high power demand and losses. Therefore, standards should have requirements that ensure that the household wiring and circuit breakers capacity limits are not exceeded. Furthermore, the load profiles of residential areas would lead to high capacity factors on the distribution network equipment. Thus, standards should provide fast charging limits to ensure that the distribution network equipment are operating in their safe operation area.

2.3. Lithium-ion battery safety standards

The recall of the portable power stations by South Africa's National Consumer Commission were caused by a lithium-ion battery manufacturing flaw. Lithium-ion batteries are prone to overheating and thermal runaway when they are damaged or have quality issues. Once a lithium-ion battery goes through the thermal runaway mechanism and processes it causes a fire or explosion [7].

In the electric vehicle (EV) industry, the root causes that may cause thermal runaway of lithium-ion batteries and the resulting fire or explosion are mechanical, environmental, and electrical damages. Based on the root cause, there are standard requirements to prevent or reduce possibly of a fire or explosion [7]. Similarly, these root causes are defined below in the context of South African end-user's interactions with the lithium-ion battery low-cost back-up systems and the proposed standard requirements.

a) **Mechanical damage** – An end-user is likely to drop a portable power station from a table or place it in a space where it is subjected to impacts from nearby objects while travelling in a car. Therefore, standards should include the drop, vibration, and housing impact levels that the back-up systems should withstand.

b) **Electrical damage** – An end-user is likely to charge the back-up power system overnight or purchase an underrated back-up system that repetitively fully discharges after a power outage or plug in a higher power rated device (e.g., hair dryer). Thus, overcharge, over-discharge and overload protection requirements should be included in the standards. Furthermore, cables that are repeatedly connected and disconnected between the portable power station and mains plug may wear the cable's insulation. Therefore, external short circuit protection should be added to the standard's requirements. Lastly, back-up power systems may be placed in a workshop garage and get exposed to conductive particles that enter through the cooling vents. Therefore, standard requirements for ingress protection of the battery pack should be included to prevent an internal short circuits.

c) **Environmental damage** – An end-user may put a back-up system close to a heater or campfire; accidently pour water over it; be located at Highveld or travel to Lesotho which exposes the systems to high altitudes. Thus, high temperature endurance, water ingress and low pressure requirements should be included in the standards. Furthermore, thermal shock cycle withstand limits should be

considered as well because an end-user may move the device from a cold to warm environment and vice versa.

Thermal runaway of lithium-ion batteries causes overheating, and standards may include requirements for low-cost back-up power systems to indicate through alarms or lights that there is risk of fire or explosion when certain high temperatures are exceeded. Furthermore, the cooling system requirements should include cooling performance requirements that can prevent high temperatures from developing while charging or discharging.

Standards should also include requirements for labelling that will indicate to end-users that the air ventilations pathways should not be blocked. Furthermore, labels for sensitivity to mechanical impacts should be put on the back-up systems to inform the end-users to handle the back-up systems with care.

The ending of load shedding also has implications of how the back-up power systems will be stored or remain in operation. The end-users should be made aware of the hazards of the products when they are not in use or continuously left in operation (e.g., mini-UPSes)

2.4. Power electronics standards

Low-cost back-up power systems have power electronics that charge the batteries and provide dc or/and ac output for the end-user's appliances or devices. The standards relating to power electronics should consider the following:

- Electrical safety requirements for the voltage levels used on the inputs and outputs of the back-up systems that will provide health and safety of end-users that will come in contact, be close and operate the systems in their various physical environments.
- Electromagnetic compatibility (EMC) requirements to ensure that the electromagnetic emissions from the back-up systems are low and that they are immune to electromagnetic interference from devices that they would be exposed to.
- The surge protection levels to protect the back-up systems from surges on the main plugs after a power outage.
- Overvoltage and undervoltage protection of the back-up systems when connected/charging from the grid and other applicable sources such as a car or solar panel.
- Overvoltage, undervoltage, short circuit and overload protection of the appliances connected to the back-up systems.
- Maximum and peak power capability for the appliances and devices that would be connected to the back-up system.
- The power quality (e.g., harmonics) requirements of the charging sources (grid, car and solar panel) and the appliances and devices that connect to the back-up system.
- Protection requirements to prevent back-up systems from being used as always-on, pass-through solutions such as UPSes.
- Restriction of hazardous substances (RoHS) in electronic components and solders.

2.5. Diagnostics

Diagnostics on the low-cost back-up power systems may prevent or reduce harm to end-users when they are presented with a fire or explosion risk. Therefore, standards should include diagnostics requirements that will be simple for end-users to interpret and cost effective for manufacturers to implement.

2.6. Lighting Back-up Systems

During load shedding at night, a household may use rechargeable lanterns or rechargeable bulbs for lighting. Manufacturers of rechargeable lanterns have started to use lithium-ion batteries in their products. Therefore, these lanterns should also be included in the low-cost back-up power systems standards. The lanterns are more likely to fall as end-users move around the house with them. Hence, these may require different mechanical damage withstand limits. The rechargeable bulbs also contain lithium-ion batteries, and they pose another risk of an end-user not being able to sense the odour of smoke in time, if a fire occurs, because of the height of the fire location. Therefore, standards should provide requirements for fire suppression of rechargeable bulbs.

2.7. Cost of Conformance to Standards

The impact of the cost of conformance on the price that consumers would pay for the low-cost back-up power systems will have to be considered as standards are being developed. A high price impact may lead to counterfeit and untested products in the market which would further pose health, safety, and environmental risks. Conversely, standards may provide an opportunity for manufacturers to reduce the number of tests they conduct on their products and reduce material costs due to optimised safety factors.

3. CONCLUSION

Load shedding has increased the usage and number of low-cost back-up power system in South African households. The low-cost back-up systems are used to power various appliances and devices during power outages. However, a recall has been issued on some of the back-up systems due to manufacturing flaws. Furthermore, lithium-ion battery waste management of low cost back-up power systems in use and still to be purchased will be required. In response to these challenges, this essay has proposed safety and performance standards to provide safety to end-users, prevent environmental pollution, improve energy efficiency and reliable low-cost back-up power systems. wn

Safety Standards and Innovative Approaches for Low-Cost Back-Up Power Systems in the Context of South Africa's Electricity Crisis

By Mr Leon Roos - 2nd place winner

South Africa is currently grappling with an electricity and economic crisis, which necessitates the exploration of low-cost back-up power systems as alternative energy solutions. Ensuring the safety, reliability, and performance of these systems is of paramount importance. This essay delves into the specific safety standards and performance requirements that should be included in the standard for low-cost back-up power systems in South Africa. It considers aspects such as cost-effectiveness, performance metrics, cooling mechanisms, cyber security measures, building regulations, training of apprentices, availability of electricians, governmental influences on registration processes, the influx of inferior products, product certification and governing certification (NRCS), and the current Electrical Installation Regulations promulgated in the Occupational Health and Safety Act. Additionally, this essay explores innovative approaches to enhance the safety of low-cost back-up power systems. By examining these factors and embracing new methods, South Africa can achieve a safer, more resilient, and sustainable energy landscape.

South Africa has faced significant challenges in its electricity supply, leading to frequent blackouts. The development of low-cost back-up systems will target the challenges that are faced within South Africa. This requires crucial considerations for establishing safety standards and performance requirements in the code of practice for low-cost back-up power systems.

Low-cost back-up power systems should strike a balance between affordability and performance. This necessitates the identification of cost-effective components, efficient system designs, and streamlined manufacturing processes within South Africa itself.

Additionally, standardisation and bulk procurement strategies can help reduce costs and make back-up power systems more accessible to a wider population.

Cost Aspect of Low-Cost Back-Up Power Systems

The cost aspect is a crucial consideration when developing and implementing low-cost back-up power systems. In South Africa, where the electricity and economic crisis is a pressing issue, affordability plays a significant role in making these systems accessible to a wider population. This section will delve deeper into the cost considerations involved in low-cost back-up power systems and explore strategies to achieve cost-effectiveness without compromising safety and performance.

To ensure affordability, it is essential to identify cost-effective components and design efficient system configurations. In South Africa, where the cost of energy is a concern for many households and businesses,

low-cost back-up power systems can provide a viable solution. By leveraging economies of scale and implementing standardisation measures, component costs can be reduced. Bulk procurement strategies, where components are purchased in large quantities, can also contribute to cost savings. Collaboration among manufacturers, suppliers, distributors and government can facilitate the procurement process, enabling competitive pricing and enhancing affordability.

Another aspect to consider is the local manufacturing of components and systems. Establishing local manufacturing facilities can reduce the reliance on imported products and lower associated costs. Promoting local manufacturing through incentives, subsidies, or tax benefits encourages investment in the sector. Supporting research and development efforts can lead to technological advancements and innovations that further drive down costs. An increase in the local manufacture of components will also lead to job creation which will further help combat the economic crisis in South Africa.

Furthermore, optimising system design is crucial to cost-effectiveness. Customised solutions tailored to individual applications and end-user needs can prevent overspending on unnecessary features or capacity while still meeting power demands during outages or disruptions. Integrating intelligent energy management systems can optimise resource utilisation and minimise wastage, thereby reducing operational costs.

When discussing the cost aspect, it is important to emphasise the long-term benefits of low-cost back-up power systems. While the initial investment may seem higher compared to traditional power solutions like diesel generators, the long-term cost savings can be significant.

Back-up power systems often rely on renewable energy sources or energy storage technologies, offering lower operational costs and reduced reliance on fossil fuels. With the declining costs of renewable energy technologies such as solar panels and battery storage systems, the overall cost of implementing low-cost back-up power systems is expected to decrease further in the future.

In addition to the upfront costs, ongoing maintenance and operational costs must be considered. Implementing preventive maintenance programs and conducting regular inspections can help identify potential issues before they become major problems, reducing overall maintenance costs. Moreover, ensuring the availability of spare parts and establishing a robust supply chain for replacement components can contribute to cost-effectiveness by minimising downtime and operational disruptions.

To comprehensively address the cost aspect, it is essential to involve stakeholders from various sectors. This includes collaboration between government agencies, regulatory bodies, industry associations, manufacturers, and end-users. By working together, cost optimisation strategies can be developed, cost-sharing models can be explored, and financial incentives can be provided to encourage the adoption of low-cost back-up power systems.

Programs such as rent to buy options or financing options through the banking sector are also excellent methods of increasing affordability. The end user would not have to spend a lot of money up front and would rather pay it off over a few years through an independent finance house or the cost can be added to the bond of the property.

While cost-effectiveness is crucial, it should not be prioritised at the expense of safety, reliability, and performance. The standard for low-cost back-up power systems should incorporate the safety standards and performance requirements discussed in this essay to ensure that affordable solutions do not compromise the overall quality and effectiveness of the systems.

Public Awareness of the Act and Regulations

Public awareness of the Occupational Health and Safety Act 1993 and the Electrical Installation Regulations 2009 is crucial for ensuring the safe and responsible use of low-cost back-up power systems in South Africa.

These regulations provide a framework for promoting occupational health and safety, particularly in relation to electrical installations. By understanding their responsibilities under these regulations, users can actively contribute to the safe operation and maintenance of these systems.

The Occupational Health and Safety Act (OHSA) 1993 is a comprehensive legislation aimed at protecting the health and safety of workers and the public. It sets out general duties for employers, employees, and self-employed individuals to ensure a safe working environment. Within the OHSA, the Electrical Installation Regulations 2009 specifically address electrical installations and provide guidelines for their design, installation, inspection, testing, and maintenance.

For users of low-cost back-up power systems, it is important to be aware of their responsibilities under these regulations. Users should ensure that the installation of these systems is carried out by competent individuals who comply with the relevant regulations and standards. It is essential to engage qualified electricians and electrical contractors who possess the necessary knowledge and skills to install and maintain these systems safely.

Users should also be mindful of the importance of regular inspections and testing of the electrical installations. The Electrical Installation Regulations stipulate that periodic inspections should be conducted to assess the condition of the system and identify any potential hazards or defects. By adhering to these inspection requirements, users can proactively identify and rectify any issues before they escalate into safety risks.

Maintenance plays a vital role in ensuring the continued safe operation of low-cost back-up power systems. Users should familiarise themselves with the manufacturer's guidelines and recommendations for maintenance procedures. Regular maintenance activities, such as cleaning, inspection, and testing, should be performed as per the prescribed intervals to maintain the reliability and safety of the system.

Furthermore, users must understand the importance of exercising caution and following safety procedures when interacting with these systems. This includes avoiding unauthorised modifications, overloading the system, or using incompatible equipment. Users should also be aware of the risks associated with electrical hazards, such as electric shocks and fire, and take appropriate precautions to mitigate these risks.

Public awareness campaigns and educational initiatives play a vital role in disseminating information about the Occupational Health and Safety Act and the Electrical Installation Regulations to users of low-cost back-up power systems. These campaigns can be conducted through various channels, including media platforms, community organisations, and public service announcements. By providing accessible and understandable information, users can better comprehend their responsibilities and make informed decisions regarding the safe use and maintenance of these systems.

By actively participating in public awareness campaigns and education programs, users can contribute to a culture of safety and ensure the wellbeing of themselves and others.

Safety Standards and Performance Requirements

Compliance with established regulations is essential to ensure the safety and reliability of low-cost back-up power systems in South Africa. These regulations set forth specific standards and guidelines that must be followed to mitigate risks and ensure the proper functioning of such systems. In South Africa, several key regulations are relevant to the installation and operation of these systems, such as SANS 10142-1.

SANS 10142-1, known as the South African National Standard for the Wiring of Premises - Part 1: Low-voltage installations, provides comprehensive guidelines for electrical installations. This standard covers various aspects, including wiring, earthing, circuit protection, and isolation measures. It ensures that the electrical infrastructure of back-up power systems is designed and implemented in a safe and reliable manner. By following the guidelines outlined in SANS 10142-1, installers and users can minimise the risk of electrical faults, fires, and other hazards.

SANS 10142-1-2 is in process of being written and released as an extension in regards to Small Scale Embedded Generation(SSEG).

The guidelines provided by SANS 10142-1 emphasise the importance of proper wiring practices, including the selection of appropriate cables, correct sizing, and installation techniques. These guidelines also highlight the significance of effective earthing and grounding systems to ensure electrical safety. Additionally, SANS 10142-1 addresses the need for adequate circuit protection measures, such as the use of circuit breakers or fuses, to safeguard against overcurrent situations.

Isolation measures, including the provision of accessible switches or disconnecting devices, are also emphasised to enable safe maintenance and repair activities.

IEC 60364, an international standard, focuses on electrical installations for buildings. It provides detailed requirements for the design, selection of equipment, wiring systems, and protection against electrical hazards, especially around direct current devices and machinery such as batteries and photovoltaic solar panels. Adherence to this standard will ensure that low-cost back-up power systems in South Africa comply with recognised global standards, promoting compatibility, reliability, and safety in electrical installations.

IEC 60364 covers a wide range of topics, including installation design principles, selection of appropriate cables, and the use of proper wiring methods. It also emphasises the need for effective protective

measures, such as residual current devices (RCDs), to detect and mitigate electrical faults. Furthermore, the standard highlights the importance of proper earthing and bonding practices to ensure the safety and performance of electrical systems. By incorporating the principles and guidelines outlined in IEC 60364, the design and installation of low-cost back-up power systems can meet recognised global standards.

IEC 60950 specifically focuses on the safety requirements for information technology equipment, including power supplies, battery systems, and backup power sources. This standard ensures that the components used in low-cost back-up power systems meet the necessary safety requirements. It provides guidelines for manufacturers and users to ensure the safe and reliable operation of these components.

IEC 60950 addresses various aspects of equipment safety, such as electrical insulation, protection against electric shock, and protection against thermal hazards. It also emphasises the importance of appropriate environmental conditions for the operation of equipment and the need for effective cooling mechanisms to prevent overheating.

By complying with IEC 60950, users can trust that the components integrated into their low-cost back-up power systems meet the necessary safety standards and reduce the risk of equipment malfunctions and accidents.

All of these recommendations are not limited to the industry alone; they also hold significance for governments and regulatory bodies. By adopting and enforcing these regulations, authorities can help ensure the safety of the population and protect the environment.

Compliance with these standards and guidelines should be a collective effort, involving manufacturers, installers, users, and regulatory bodies.

Regular inspections, audits, and certifications play a crucial role in verifying compliance and promoting a culture of safety and responsibility. These activities can help identify non-compliance and provide an opportunity for corrective actions to be taken promptly. Additionally, comprehensive safety training programs should be implemented to educate users about their responsibilities in terms of these regulations. By increasing public awareness and knowledge of the Occupational Health and Safety Act of 1993 and the Electrical Installation Regulations of 2009, users can better understand their role in ensuring the safe and effective operation of low-cost back-up power systems.

These regulations provide guidelines for electrical installations, equipment selection, and safety requirements. By adhering to these standards, users can mitigate risks, prevent electrical hazards, and ensure the proper functioning of their back-up power systems. Governments and regulatory bodies must play an active role in promoting and enforcing compliance to safeguard the well-being of the population and preserve the environment.

To ensure optimal performance, low-cost back-up power systems should adhere to the following performance requirements:

Power Output: The system should deliver the required power output, meeting the demand of the connected load during an outage or power disruption.

Efficiency: Emphasise energy efficiency to minimise power losses during conversion or storage processes and maximise the utilisation of available resources.

Response Time: Ensure a fast response time, activating and supplying power to critical loads within milliseconds of a power outage to minimise disruption.

Voltage Regulation: Provide stable and regulated voltage to protect connected devices from voltage fluctuations and surges, safeguarding equipment integrity.

Battery Management Systems: Incorporate adequate BMS to sustain power supply during prolonged outages, ensuring continuous operation.

Environmental Considerations: Comply with environmental regulations by addressing proper waste management and considering the disposal of redundant system components such as Lithium products which cannot be recycled.

Additional Requirements for Safe and Efficient Back-up Power System Design and Installation

There are also additional requirements that need to be considered for the safe and efficient design and installation of low-cost back-up power systems.
These include:

- Safety Training and Guidelines
- Cooling Requirements
    - Temperature Limits
    - Cooling Mechanisms
    - Airflow Design
    - Thermal Management
- Cybersecurity Measures
    - Secure Communication
    - Authentication and Access Control
    - Encryption
    - Intrusion Detection and Monitoring
    - Regular Updates and Patch Management
- Innovative Safety Measures
    - Advanced Monitoring Systems
    - Fault Detection and Diagnostics
    - Intelligent System Controls
- Adherence to building regulations and compliance standards

The relevance of each of these points is covered in the next section.

Safety Training and Guidelines: Promoting comprehensive safety training programs and guidelines for installers, maintenance technicians, and end-users to ensure proper installation, operation, and

maintenance practices. To address the growing demand for skilled professionals in the electrical industry, adequate training of apprentices is crucial. The availability of qualified electricians is essential for the installation, maintenance, and repair of low-cost back-up power systems. Collaboration between industry stakeholders, educational institutions, and regulatory bodies is necessary to ensure a continuous supply of competent electricians.

Cooling Requirements: To maintain safe and efficient operation, low-cost back-up power systems should include specific cooling requirements, such as:

Temperature Limits: Operate within specified temperature limits to prevent overheating, component degradation, or system failures. Implement temperature monitoring and protection mechanisms.

Cooling Mechanisms: Utilise effective cooling mechanisms such as fans, heat sinks, or liquid cooling systems to dissipate heat generated during operation.

Airflow Design: Consider proper airflow design during system installation to ensure adequate ventilation and prevent the buildup of heat in confined spaces.

Thermal Management: Incorporate thermal management features such as temperature sensors and automated controls to optimise cooling and prevent overheating under varying load conditions.

As modern power systems become increasingly connected, cybersecurity measures are crucial to protect against potential vulnerabilities and threats. System components must be secured to prevent unauthorised access, data breaches, or malicious attacks. Implementing robust cybersecurity protocols, including secure communication channels, strong authentication mechanisms, and intrusion detection systems, is necessary to safeguard the integrity and confidentiality of the systems.

Secure Communication: The system should incorporate secure communication protocols to protect against unauthorised access, data breaches, or tampering with system controls.

Authentication and Access Control: Strong authentication mechanisms should be implemented to restrict system access to authorised personnel only and the personnel should be trained in cyber security and on the Cybersecurity Regulations.

Encryption: Data encryption should be employed to protect sensitive information transmitted between system components or external interfaces.

Intrusion Detection and Monitoring: Intrusion detection systems and continuous monitoring should be implemented to identify and respond to potential cyber attacks or suspicious activities.

Regular Updates and Patch Management: The system should have provisions for regular software updates and patch management to address any identified vulnerabilities or security flaws.

Innovative Safety Measures: In addition to traditional safety standards, integrating innovative safety measures can enhance the resilience and reliability of low-cost back-up power systems. Some approaches to consider include:

Advanced Monitoring Systems: Deploying advanced monitoring systems that provide real-time data on system performance, temperature, voltage, and battery health, allowing for proactive maintenance and immediate detection of potential issues.

Fault Detection and Diagnostics: Implementing fault detection and diagnostic algorithms that can identify and isolate faults within the system, enabling quick response and minimising downtime.

Intelligent System Controls: Incorporating intelligent system controls with built-in safety features, such as loadshedding capabilities during system overload or voltage irregularities, to protect against equipment damage and ensure safe operation.

Adherence to building regulations and compliance standards is crucial for the safe installation and operation of low-cost back-up power systems. In South Africa, the building regulations govern where these systems may be installed as it is considered to have a high risk of flammability. This is covered within SANS 10400, which needs to be included in the consideration with the updating of current standards and encompasses electrical installation requirements, permitting procedures, and inspection protocols.

Compliance with these regulations, such as the Electrical Installation regulations (2009) promulgated in the Occupational Health and Safety Act, is necessary to ensure the proper functioning and safety of the systems. Inspection processes should be established to verify compliance during system installation, and ongoing maintenance procedures should be implemented to ensure continued adherence to safety standards. The verification of compliance should not only done by the person who installs the system, but also by an Approved Inspection Authority, which is already promulgated within the regulations.

The regulations need to be updated to include certain definitions of the latest technologies and to make space for a governing quality control council which is led by the Inspection Authority. These measures will ensure that people, property and animals are protected against shock and fire.

The Role of Governmental Influence on the Registration Process of Low-cost Back-up Power Systems

Governmental influences play a significant role in the registration processes for low-cost back-up power systems. In South Africa, the National Energy Regulator of South Africa (NERSA) regulates the standards for grid connected power systems. These standards need to be enforced in such a manner to ensure people's safety. The guidelines are published in NRS-097, which regulates the products that may be installed.

The National Regulator for Compulsory Specifications (NRCS) regulates product certification and establishes the requirements for compliance. Adherence to the guidelines outlined in NRS-097 is essential for

manufacturers, importers, and distributors to ensure that their products meet the required safety, quality, and performance standards. The NRCS plays a crucial role in market surveillance, auditing, and enforcement of compliance, thereby contributing to the overall safety and reliability of low-cost back-up power systems in the country.

The influx of inferior products into the South African market poses risks to the performance, reliability, and safety of low-cost back-up power systems. Product certification programs, such as those governed by the NRCS, play a crucial role in verifying the quality, compliance, and adherence to relevant standards. Ensuring that products undergo thorough certification processes helps mitigate the risks associated with substandard or counterfeit products. Market surveillance and strict enforcement of certification requirements are necessary to maintain the integrity and quality of low-cost back-up power systems in the country.

NERSA has recently introduced a new standard to grid connections which limits the size of the generator that may be installed on the premises. This would also help the end user by not spending too much money on a power system which is not necessary.

A comprehensive compliance approach is vital to the success of low-cost back-up power systems in South Africa

Given the current electricity and economic crisis, it becomes even more critical to ensure the effectiveness and resilience of these systems.

By integrating established safety standards, performance requirements, cooling mechanisms, and embracing innovative safety measures, South Africa can pave the way for a sustainable energy landscape that meets the needs of its population.

One crucial aspect of this comprehensive compliance approach is the integration of international standards into the South African National Standards (SANS) 10142-1. Incorporating standards such as IEC 60364 and IEC 60950 ensures that the low-cost back-up power systems adhere to globally recognised safety practices. This alignment not only provides a robust framework for ensuring the safety and performance of the systems but also facilitates interoperability and compatibility with international markets. By conforming to international standards, South Africa can position itself for future growth, collaboration, and integration with other energy systems.

To enhance the safety and reliability of low-cost back-up power systems, the adoption of advanced monitoring systems, fault detection algorithms, and intelligent system controls is essential. Real-time monitoring of critical parameters, including temperature, voltage, and battery health, enables proactive maintenance, early fault detection, and prompt responses. By leveraging these technologies, potential issues can be identified and addressed promptly, minimising downtime and preventing potential damage. Additionally, intelligent system controls play a vital role in regulating system operations, ensuring safe and efficient performance, and protecting against overload and voltage irregularities.

Comprehensive safety training and education programs play a pivotal role in the successful deployment and operation of low-cost back-up power systems. It is imperative to raise awareness among installers, maintenance personnel, end-users, and building occupants about safety protocols, emergency procedures, and potential hazards associated with these systems. Regular training sessions, workshops, and informative materials contribute to a safety-conscious culture, empowering stakeholders to make informed decisions and take appropriate actions in utilising and managing the systems.

By embracing a comprehensive compliance approach that encompasses both traditional and innovative safety measures, South Africa can establish itself as a leader in the deployment of low-cost back-up power systems. This approach not only addresses the current electricity crisis but also contributes to the long-term energy resilience and sustainable development of the country.

Furthermore, it positions South Africa for greater energy independence, reducing reliance on the national grid and mitigating the impact of frequent power outages on the economy and daily life.

In conclusion, prioritising safety, adhering to international standards, incorporating advanced technologies, and promoting safety awareness are pivotal steps in the successful implementation of low-cost back-up power systems in South Africa. These systems offer a reliable alternative during power outages, enhance the overall stability of the electricity infrastructure, and contribute to a brighter and more prosperous future for the nation. By adopting a comprehensive compliance approach, South Africa can ensure the safety, reliability, and performance of these systems, ultimately leading to a resilient and sustainable energy landscape for its citizens. wn

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As the economic sky darkens, it's time to get cloud costs under control

While South Africa has fended off the threat of recession after recording a slight growth in the first quarter of 2023, the global tech industry is still cautious as it prepares to weather the storm.

By Michael Cade, Global Field CTO Cloud-Native Product Strategy at Veeam

Tech companies are looking at optimising their costs across the board, with one such area topping the list of CIOs being controlling cloud expenditure. The cloud's recent fortunes have also been closely tied to the pandemic, with the market for cloud services doubling in just three years since 2020. So, if the pandemic bubble is truly over, will the cloud burst with it? Not necessarily, as cutting cloud costs doesn't mean cutting back on the cloud altogether.

GREAT EXPECTATIONS

It might seem obvious, but at times, it's worth reminding ourselves that optimising costs was one of the main reasons for adopting cloud strategies. And it's not simply a case of too much of a good thing - despite research indicating that 61% of South African organisations spent more on cloud solutions in 2021 than in 2020, with the public cloud services market expected to increase at a compound annual growth rate of 24.5% through to 2025.

So, despite the cloud promising cheaper pastures, in reality, many CIOs are still waiting for the initial investment to pay off, but how has this happened?

Even though, when leveraged correctly, the cloud can greatly reduce costs, it's important to remember that cloud providers aren't in the business of saving you money. If you're ordering from your favourite pizza chain and adding extra topping after extra topping, they won't stop you and ask, "Are you sure you need all that?"

The cloud's value is that you pay for what you need, but therein lies the issue - its flexibility is a double-edged sword. This has caught out many a CIO to the point where "bill shock," once reserved for utilities, has become synonymous with cloud computing. Bills can scale out of hand not just because it's easier than ever to build out new environments but because IT teams can often be focused on looking forward to what they will need next and not always looking back to what they don't need anymore.

ENTER FINOPS

This is why we've seen the rise of Financial Operations (FinOps) in recent years. Operations teams have historically never had to worry about day-to-day costs, but the rise of the cloud has brought with it OpEX-dominated budgets. Looking at IT operations through a financial lens is vital to controlling these costs, particularly on an enterprise scale.

The options for optimising cloud costs are broad, and choosing the right strategy for your environment is often the first hurdle for Ops teams. Both viable options are re-platforming or repatriating to a new cloud or back to the old physical server. However, they both present a big initial lift while often not necessarily fixing the issue at the source, not to mention having to navigate around vendor lock-in.

Rather than trying to pull away, many opt to dive even deeper into the cloud and re-architect with cloud-native models and services to try and offload costs. This might include better-managing VM instances, implementing intelligent tiering for storage costs or implementing containers and Kubernetes. However, the latter needs to be set up correctly, or it can wind up being just as much of a drain on budgets. If the cloud's flexibility is a double-edged sword, Kubernetes is an even bigger blade, offering more

Michael Cade
Global Field CTO Cloud-Native Product Strategy at Veeam

upside but more financial risks if mismanaged.

This is a good example of how key consideration personnel and skills are when optimising cloud spend. The cloud skills gap is an ongoing issue for the industry and a large factor in why we're in this position, to begin with. The pandemic essentially forced many businesses (and their IT teams) to launch into the cloud without enough time to prepare, and now many are (quite literally) still paying the price. Since then, while the gap might be closing slowly, many teams lack the expertise to undertake the large-scale re-architecting required to optimise costs. Businesses must look at outside expertise or alternatives such as dedicated cost-saving modules or automated cloud cost optimisation solutions.

THE MISSING PIECE

Finally, it's crucial that during this cloud optimisation decision-making, security and data protection aren't neglected. With cyber threats like ransomware becoming increasingly ubiquitous, businesses must stay as resilient to these threats as possible, or short-term savings could lead to long-term pain. According to the 2023 Veeam Ransomware Trends Report, 85% of organisations suffered at least one cyber-attack in twelve months, an increase from 76% experienced in the prior year, so now is not the time to cut back on protection in the cloud.

This must stay top-of-mind, for example, when looking at storage costs for cloud-hosted backups or changing storage tiers for existing workloads. Essentially, decisions for each workload in the environment must be made considering these three factors - operations, finances and data protection.

This may mean that while businesses aim to push overall cloud spending down, data protection as a fraction of this may continue to increase. Indeed, most organisations worldwide expect to increase their data protection budget in 2023 by 6.5% (5.8% in the Middle East and Africa), according to the Veeam Data Protection Trends Report 2023, which is notably higher than overall spending plans in other areas of IT.

Even during a boom, you'd argue that businesses need to get wasted cloud expenditure under control. Still, against economic uncertainty and a technology sector licking its wounds, it's more important than ever. While strictly speaking, the best time to act was early on, when workloads were first moved to the cloud, the next best option is now. After all, you know what they say about the best time to plant a tree... wn

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SAIEE CALENDAR

AUGUST 2023

15/08/2023	Incident Investigation & Root Cause Analysis
15/08/2023	Hack Lab
15/08/2023	LV/MV/HV Switch Gear Operation, Safety, Maintenance and Management
15/08/2023	KZN Centre ST-Talk: Entrepreneurial Journey - from ideas to market | UKZN Smartgrid Centre
16/08/2023	Fundamentals of Medium Voltage Protection
16/08/2023	ECC Short Talk: Introduction to the Xe-100 Pebble Bed Reactor to Support Grid Stability
16/08/2023	SAIEE ST-Talk: Can Eskom be saved?
17/08/2023	SANS 10142-1 -Edition 3
17/08/2023	LV/MV/HV Switch Gear Operation, Safety, Maintenance and Management
18/08/2023	Eastern Cape Centre site vist: Mercedes-Benz - East London
22/08/2023	Introduction to Artificial Intelligence for Professionals
24/08/2023	Fundamentals of Practical Lighting Design for Commercial and Industrial Applications
24/08/2023	Nuclear Chapter webinar
29/08/2023	Operating Regulations For HV/MV Systems - ORHVS
29/08/2023	Project Management for Engineers
29/08/2023	Arc Flash
30/08/2023	KZN Centre Celebrating National Women's Day | Durban

SEPTEMBER 2023

01/09/2023	Legal Liability: Occupational Health and Safety Act (OHS Act)
05/09/2023	Blockchain and Money
06/09/2023	High Voltage Measurement and Testing
06/09/2023	Gaining an insight, understanding, and application of the Protection of Personal Information Act 4 of 2013 (POPIA)
07/09/2023	KZN Centre site visit: Conlog | Durban
13/09/2023	Select, Maintain & operate your Rotating Electrical Machines like a Pro
14/09/2023	Anatomy of Wind Turbines
20/09/2023	Fundamentals Of Developing Renewable Energy Plants
21/09/2023	Writing Good Technical Specifications
26/09/2023	Road to Registration
26/09/2023	Fundamentals of Power Distribution

Section & Chapter, Centre Events SAIEE Academy Online Training SAIEE Academy Classroom Training

REVIVE

REVIVE ELECTRICAL TRANSFORMERS (PTY) LTD

Revive Electrical Transformers (Pty) Ltd is one of the leading manufacturers of distribution transformers in South Africa, with two manufacturing facilities in Gauteng: Steeledale and Kliprivier.

Established in 1997, our company has grown tremendously along the way and acquired the knowledge and experience needed to make us experts in our field.

Our business prospects are based on sound manufacturing and quality processes, a sound fiscal discipline, and growing customer base.

The company has been awarded various accreditations and conforms to most local specifications and international requirements.

Product quality, delivery and after-sales service is paramount to our organization.

TRANSFORMERS ARE OUR BUSINESS

OUR PRODUCTS

- OIL DISTRIBUTION TRANSFORMERS
- OIL MINI-SUBSTATIONS
- NECRT
- PV SOLAR TRANSFORMERS
- CUSTOM-BUILT TRANSFORMERS
- SURGE ARRESTORS
- CAST RESIN DISTRIBUTION TRANSFORMERS
- CAST RESIN MINI SUBSTATIONS
- SWER TRANSFORMERS
- WIND FARM TRANSFORMERS
- COMPLETE SUBSTATIONS
- AUTO RECLOSURES

Dry-Type Mini Substation

Cast Resin Transformer

Complete Solar Substation

BBBEE Level 1

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